SCIENTIFIC AMERICAN

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LENGTHENING A HUDSON RIVER STEAMBOAT.

Whenever the historian shall take up his pen to write the complete story of steam navigation, if he be a fit man for his task, with a due sense of perspective and proportion, he will write large and lengthily the chronicles of "steamboating" on the waters of the Hudson River. Here, surely, if anywhere, we must look for the cradle and nursery of the practical steam propelled freight and passenger carrying vessel; for when Robert Fulton dispatched the Clermont, a 160 ton steamer, on its first trip from New York to Albany on the morning of August 7, 1807, he established his claim as the father of the steamship with as much certainty as the Rocket in a later day entitled Stephenson to be called the father of the locomotive.

The Clermont was a worthy ancestor to the fleet of truly magnificent boats which have made the Hudson River service the most famous of its kind in the world. The requirements of the service have produced two distinct classes of boats, those for night service, carrying both freight and passengers, of which the Adirondack, of the People's Line, is the finest and latest example, and another class for day service, represented by the historic Mary Powell and the swift and luxurious New York and Albany, of the Albany Day Line. Each type of boat has been designed with special reference to the necessities of night or day service. The night boats, as exemplified in the Adirondack, are characterized by large freight-carrying capacity, lofty tiers of staterooms for the accommodation of passengers, and a high rate of speed, the boat named having made about 20 knots under favorable conditions. The day boats, carrying no

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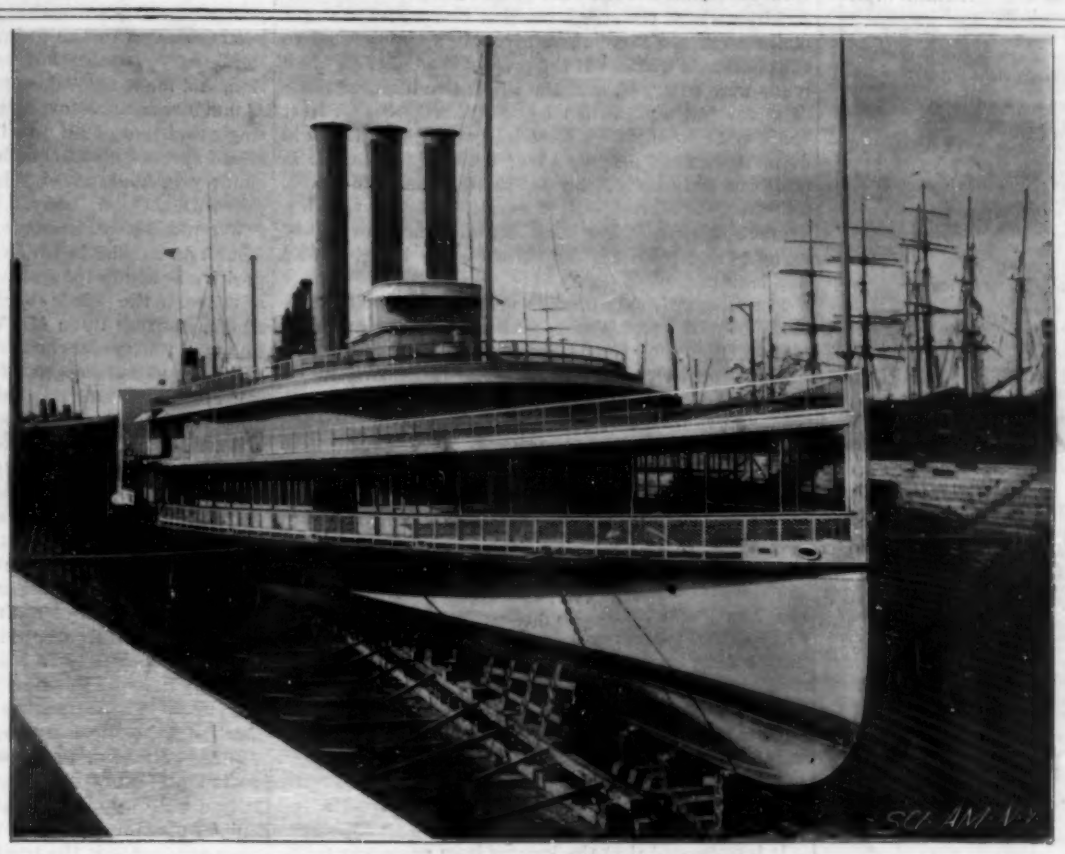
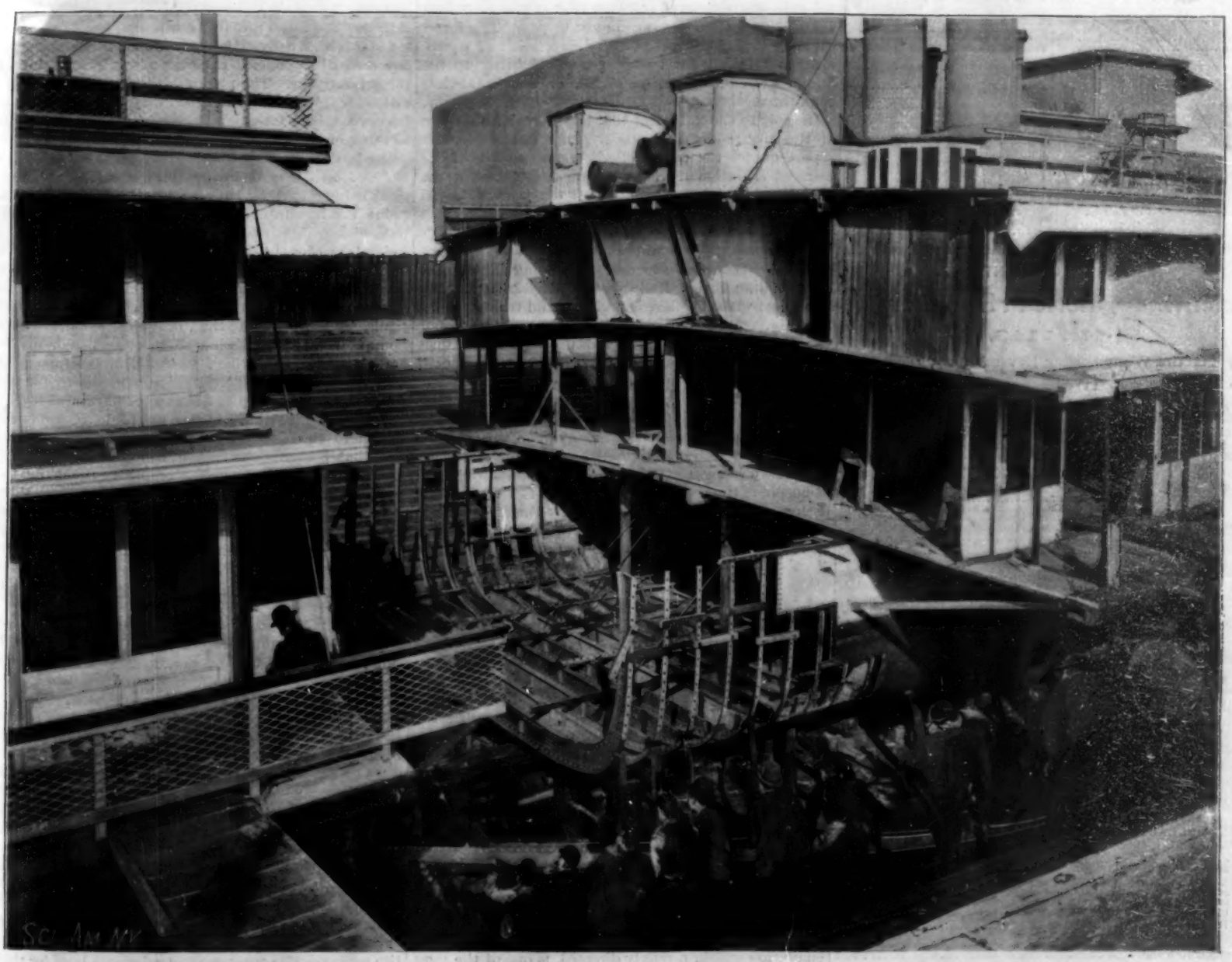


BOW VIEW, SHOWING SLIDING WAYS.



LENGTHENING A HUDSON RIVER STEAMBOAT—THE HULL PULLED APART—FRAMING THE NEW SECTION.

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APPELLATE COMMISSION REPORT FAVORABLY ON THE NEW YORK RAPID TRANSIT SCHEME.

The commissioners appointed by the Appellate Division of the Supreme Court to determine whether the rapid transit tunnel should be constructed have filed a report in favor of the building of the road. Every one who is intelligently informed as to the problem of transportation in this city, and is disposed to look at the question from a broadminded standpoint, will be glad to know that this, the greatest and most needed improvement in the history of the city, is now in a fair way to be accomplished. So rapid is the growth of New York that not even the great enlargement of their facilities which the street traction companies are now making can do more than give a temporary relief to the congested traffic. If the present system of elevated roads were enlarged, and the whole two hundred miles of street railways owned by the Metropolitan Street Railway Company were electrically equipped, it would do no more than provide a seat for every passenger in the busiest hours of the day; and unless the tunnel scheme were carried out, it would be but a very few years before the New York business man would be going to and from his downtown office hanging to a hand strap.

The report disposes of the so-called engineering risks and perils, of which the opposition has attempted to make so much, by stating at once that the road as proposed is entirely practicable. The objections raised against the Broadway scheme on the score of encroachments on vault spaces are, in the opinion of the commissioners, entirely avoided in the Elm Street plans, which call for a fifty foot width, as against a seventy foot width in the Broadway plan. The cost will not exceed $35,000,000, and in the opinion of the board $30,000,000 will pay for the road.

In regard to the second objection that the road, if built, would not pay expenses, it is estimated that as the Third and Sixth Avenue elevated railroads now carry 300,000 passengers per day, the tunnel road would have a daily capacity of 425,000. The passenger traffic of the city is increasing at the rate of 20,000,000 a year, which in the five years that will be consumed in building the new road would amount to 300,000 a day more than are now carried on all roads. This increase, together with the surplus which is now overcrowding the existing roads, should give the new road a full volume of travel.

It is estimated that the income from passenger traffic and advertising would reach $5,575,000, and the operating expenses, estimated at 60 per cent of the passenger traffic receipts, are put down at $3,285,000. The interest on $35,000,000, together with depreciation of equipment and sinking fund payment, would bring up the annual expenditure to $5,557,000, or somewhat less than the receipts.

In reply to the statement that the financial condition of the city renders the undertaking impossible, the report quotes the comptroller's testimony that if the assessed valuation of real estate increases as fast in the next decade as it has in the past ten years, it would allow the city to incur an indebtedness of $135,295,662 without any reduction of the margin which now exists between its net debt and the limit allowed by law.

We have spoken of the good work being done by the Metropolitan Street Railway Company in equipping its system with the electric underground trolley. Incidentally, a portion of the completed work gives a fair example of what the proposed underground transit will be like. We refer to the portion of the Fourth Avenue line which runs through the tunnel between Forty-second and Thirty-second Streets. The floor was asphalted and the walls and arch were whitewashed just before and after the laying of the splendid track with which the tunnel is equipped. The new cars now pass swiftly and with little noise through an atmosphere that is as pure as the most fastidious could desire, and any one that travels by this route must admit that the discomforts of the proposed rapid transit tunnel will prove to be more imaginary than real.

THE QUEST OF THE NORTH POLE.

In all the recorded history of our race there is nothing to compare with the unfailing persistence with which the quest of the North Pole has been carried on. It is not that men have failed to show perseverance in other enterprises of a military, scientific or romantic character, or that they have suffered less or run less risk to life and limb; but the fact that renders the search for the North Pole altogether unique and incomparable is the comparative smallness of the results which are expected to crown a successful attempt.

It is not likely that even the most practical among the many explorers who have set out for the North Pole has expected to contribute to the world's store of scientific knowledge any facts that would add greatly to its sum; and it is likely that the majority of the explorers who have gone north since the time when the impracticability of a northwest passage was proved have consciously or unconsciously been moved by the pure spirit of daring and discovery, and that spirit of emulation which, properly directed, is one of the most powerful agencies of human progress.

However, without attempting to analyze the motives which underlie these crusades of the nineteenth century, it must be admitted that their increasing frequency, their exhibition of courage and unconquerable purpose, and the ingenuity and resourcefulness with which they are in quick succession conceived and carried out, all indicate that man has set his heart resolutely upon reaching the North Pole, and that he is within measurable distance of the day when he will stand there.

The prospects of an early discovery (so called) of the North Pole are rendered more likely by the intelligent methods which are now being proposed for future expeditions. The work that has been done already has been too much of the nature of a forlorn hope. The small party that has cut loose from the main expedition, and made the "dash for the pole," has had about as much reasonable expectation of success as would a single regiment of an invading army, if it should push ahead and attempt to reach the interior of an enemy's country without maintaining its lines of communication with the main body.

We publish on another page a timely letter from Timbirsk, Russia, in which the writer dwells upon the positive necessity for systematic and strongly organized advance, if the pole is ever to be reached. The writer, in commenting upon Mr. Wellman's proposed expedition next year, points out two elements which are liable to bring on failure, one of these being haste and the other national and personal egotism: While the suggestion that such expeditions should partake of an international character, "accepting both universal subscription and universal help," is a good one, which, if adopted, would insure the expedition being carried out on the scale which, in our opinion, is necessary to success, we think that national and personal egotism has been and will continue to be a powerful and perfectly legitimate controlling factor in Arctic exploration. The element of undue haste, on the other hand, has been a fruitful cause of failure. The expedition that sets out deliberately to journey to the pole must place no strict limit to the time which will be consumed in the effort. The expedition should be considered in the light of a hostile incursion into an enemy's country, where the rate of progress will be determined by expected and unexpected resistance. It should start from a well-supplied base and should maintain a strong line of communications. If there is one thing more than another that the tragic history of Arctic exploration teaches, it is that the northern citadel can never be taken by a dashing assault.

By far the most promising attempt, judged by the standards above given, is that which will be made by our own distinguished explorer, Lieut. Peary, during the coming year. The plan of attack includes an expedition by ship through Robeson Channel to a point as far north on the Greenland coast as possible; then an advance of the party of Eskimos, with a few selected white leaders, by easy stages to the northern terminus of the North Greenland archipelago, caches of provisions being established at each headland; and from this point the inevitable "dash for the pole"—two Eskimos, picked dogs and the lightest possible equipment being taken for the final three hundred miles.

The fact that both Peary and Wellman intend to carry their lines of communication only as far north as the mainland, or archipelago, as the case may be, extends, seems to indicate that, in their opinion, it would be impossible to establish a chain of caches or depots across the sea of ice which encircles, or is supposed to encircle, the North Pole. If it is possible to place a line of depots across the floating ice beyond the land, it seems like inviting disaster not to do so, and one is driven to the conclusion that it is only the increased cost that prevents such a plan from being carried out. If our surmise is correct, the chances of reaching the pole would be very much greater if the two or three separate expeditions which are planned for next year were to join forces, and make the attempt through an unbroken line of communications and on the general lines suggested by Lieut. Peary.

REPORT OF THE SECRETARY OF THE INTERIOR.

In his first annual report, the Hon. Cornelius N. Bliss, Secretary of the Interior, deals at length and in an interesting manner on the condition, work and needs of this department of the government. We give below some of the topics touched upon in the report. In speaking of the devastation of the public domain by forest fires, the Secretary says:

"There are now existing nineteen forest reservations, embracing lands having an estimated area of 18,993,280 acres, which from time to time have been set aside by presidential proclamations. Thirteen forest reserves created by proclamation of February 22, 1897, were, with the exception of two in the State of California, suspended by the sundry civil act of June 4, 1897, until March 1, 1898. The suspended reservations contain an estimated area of 19,951,360 acres. The preservation of the public forests is a matter of vital interest to the entire nation. The enactment of adequate laws for their protection and the proper enforcement thereof, coupled

with the inauguration of a comprehensive forest system, can only effect such result.

"I most heartily concur in the recommendation of the Commissioner of the General Land Office that liberal appropriations be made by Congress for the forestry service.

"Attention is directed to the law, which provides a penalty for the cutting or destruction of live oak or red cedar, or other timber on the public lands. It is open to serious objection, in that it is inadequate for the punishment of offenses to which it relates; it fails to discriminate clearly and justly as to what constitutes a crime with respect to the use of public timber. As this law is the principal penal statute upon which the Land Department has to rely to check the waste and destruction of public timber, its failure to meet the ends desired is a serious matter, and legislation more in accord with the needs of the times should be secured."

Secretary Bliss calls attention to the report of the Commissioner of Pensions, already published, which shows that on June 30, 1897, there were on the pension rolls 976,014 names, an increase of 5,336 during the year. Of these there were 16 widows and daughters of revolutionary soldiers, 7 survivors of the war of 1812, 281 widows of soldiers of that war, 18,994 survivors and widows of the Mexican war, 6,661 survivors and widows of Indian wars, 663 army nurses and 438,064 survivors and widows and children of deceased soldiers and sailors of the war of the rebellion. The latter number represents those pensioned on account of disabilities or death resulting from army and navy service. The number of persons remaining on the rolls June 30, 1897, who were pensioned under the act of June 27, 1890, which allows pensions on account of death and disability not chargeable to the service, was 508,799.

The number added to the rolls during the year was 54,072, the number dropped from various causes was 41,122, and the number of claims of various classes disallowed was 76,234. The amount disbursed for pensions during the year was $139,799,242.12, exceeding the amount disbursed during the fiscal year 1896 by the sum of $1,584,480.18. During the year 994.454 pension certificates were issued.

The Secretary indorses the recommendation of Commissioner Evans for the passage of a law providing that no pension shall be granted to the widow of any soldier who shall hereafter marry. As to the status of pension claims generally, he says:

"There are about 200,000 pension claims awaiting adjudication, and it is estimated that 40 or 50 per cent thereof will be finally admitted. If these claims are rapidly adjudicated, they will swell the pension roll from $5,000,000 to $7,000,000.

The receipts of the Patent Office during the fiscal year exceeded the expenditures to the amount of $317,135.05, and the money covered into the Treasury from fees in patent cases from July 4, 1836, when the office was created, to June 30, 1897, in excess of the amount expended, reached the sum of $5,093,614.23. A greater number of applications for patents were filed during the year 1896 than in any previous year in the history of the Patent Office, and yet the number filed during the first six months of 1897 has exceeded by more than 7 per cent the number received in the first half of 1896. From January 1, 1897, to June 30, 1897, there were filed 25,559 applications. During the same period the total receipts of the office were $722,897.47, a gain of $102,015.50 over the six months immediately preceding. These figures are used as a basis for a recommendation for increased clerical force and office accommodations.

THE AMERICAN BEET SUGAR INDUSTRY.

(Continued from page 323.)

To sum up, then, nearly seventy years of experiment in the beet sugar manufacture in the United States has brought the industry to such a point that we can produce in one year only enough to supply the nation's requirements for about a week. Europe, on the other hand, long ago began to export beet sugar, Germany alone sending us last year some 800,000 tons, or about twenty times our home production. That we have not made better progress in so long a period is due to no climatic obstacles. We have a sugar beet belt stretching from ocean to ocean and of no mean width, inferior in few parts to Europe and in some sections surpassing its most favored beet districts in both soil and climate. The early failures must therefore be ascribed to a want of thoroughness on the part of the pioneers, due to inexperience and a lack of sufficient capital. Theirs was no easy road to travel, and it would have been nothing short of marvelous had they succeeded in securing an immediate foothold for a new manufacture and an untried crop.

This applies to all the failures recorded down to 1890. The plants were not only located unwisely, but were too small to be successful even without that drawback. Since then two factories have been thoroughly unsuccessful. The one at Staunton, Virginia, was destroyed by fire after it had been operated on a small scale, and made a very little raw sugar, and the one at Menominee Falls, Wisconsin, was not completed until toward the end of last winter, by which time the siloed beets, none too rich in the beginning, had so deteriorated in sugar content that they could not be worked up with profit, and the result was the failure of the sugar company. Neither one of these failures however, is any proof that the States of Virginia and Wisconsin are unsuited for sugar beet culture. On the contrary, experiments with the crop in various points of these States indicate that they both have desirable sections for the establishment of beet sugar factories, but any resumption of the industry must be on a larger scale, with enough capital behind the scheme to tide over the agricultural uncertainties of the first year or two. Of the other plants mentioned, none can be called a distinct failure, because they are still running, although some of them have not been as profitable as was expected when they were built. All of them had their trials at the start, and it may be said that for some years to come the first campaign or two of a new factory will not be free from tribulations of one kind or another. The oldest of them, which is operated by the Alameda Sugar Company, at Alvarado, California, achieved success only after a long uphill struggle occasioned by lack of capital and the difficulties of establishing a new branch of agriculture in a country only partially developed. Those behind the project chose their location wisely, and to this choice and their close study of the situation of the industry must be attributed the stable foundation of beet sugar manufacture in this country. Coming later, as it did, the Watsonville factory, which was recently purchased by the American Sugar Refining Company (at a figure said to be 300 for the capital stock), had its way in a measure paved for it, but still had its pioneer work to accomplish. The next plant to be installed, that of the Oxnard Beet Sugar Company, at Grand Island, Nebraska, profited in a measure by the work of its predecessors, and yet, with the untried prairie to conquer, it had obstacles that were unique. This and the one built by the Norfolk Beet Sugar Company, at Norfolk, in the same State, a year later, have had on the whole unprofitable careers, though each succeeding season has undoubtedly brought them nearer to the desired goal. Drought, excessive rains at the wrong periods, the failure of both the State and nation to redeem promises of protection by bounties, and the inability during the earlier years to convince the farmers that beets could be grown profitably at the prices offered—all made the progress of the industry in Nebraska exceedingly uphill work. The Chino factory, built by the Chino Valley Beet Sugar Company, also suffered from drought and the loss of federal bounty and was obliged to endure bad seasons before it attained the great prosperity that ultimately came to it. At Lehi, the plant of the Utah Sugar Company likewise failed to profit long by the McKinley bounty, and while drought was conquered by irrigation of the crop, the use of water at first made the beets somewhat low in sugar and purity. However, an American-built factory that could be run economically, very conservative management and the co-operation so characteristic of the Mormons, have made the course of this factory perhaps the smoothest of all. It certainly has lost nothing, even if it has not made a fortune in the six campaigns of its history. Comparatively smooth, also, has been the brief history of the plant of the Pecos Valley Beet Sugar Company, at Eddy, New Mexico. It probably had the least unsuccessful first campaign of any of our beet sugar factories, irrigation securing for it a fair sized crop of extraordinarily rich beets that but for the difficulties encountered in working it up would have realized a handsome profit. So then, to sum up the general history of the sugar beet in the United States, whatever failures there are to record may be set down to the natural obstacles that lie in the path of any new industry of such great magnitude and importance, and, far from impeding its progress, have helped to place it on a sounder basis. To-day beet sugar manufacture in this country is an established success, even if—as has been stated—nearly seventy years of experiment have given us but nine factories to work up this season's crop.

As for the future, what with the protection that the Dingley act gives sugar, and the growing desire of farmers to familiarize themselves with the culture of the sugar beet for manufacturing purposes, it is full of hope. It would be more than desirable to have this country eventually produce all the sugar that it consumes, and it is because of the possibility of some time bringing this about that the new industry is looked upon with the greatest favor and interest; for, with the cane belt so restricted to a few States that it may never have an annual output of more than a quarter of our present consumption, everything depends practically upon the sugar beet. Allowing for the cane crop of the Southern States and Hawaii (the latter must be included, as it enters free of duty), we should require some 350 beet sugar factories, each with a daily capacity of 500 tons of beets, to manufacture the sugar that we now import; and, considering the rapid growth of this nation, before the erection of so many expensive plants could be brought about, it can readily be seen that there will be little danger of over-production for years to come. Thus far, California has shown the greatest development. Its four factories will, this season, turn out about two-thirds of all the beet sugar made in the United States, and, if the various projects in the air materialize, another year will see an immense increase in the output of this State.

Claus Spreckels is building at Salinas a plant which it is claimed will have a daily capacity of 3,000 tons of beets, thus exceeding by about 500 tons the largest one in Europe. Rumor has it also that one of the sugar king's sons is about to build a big factory, and that still another for both beets and Hawaiian raw sugar will go up at Crocketts.

The special advantages of California are several. In the northern part, where the Watsonville and Alvarado plants (both within 100 miles of San Francisco) have shown the best average results thus far obtained in this country, the soil and climate possess not only the best qualities of Europe—excellent beets growing hand in hand with very high tonnage—but it is surpassed in one important respect, the short winter season permitting planting to be distributed over a long period and harvesting prolonged, without danger of killing frosts.

Southern California makes even greater claims for superiority. It has a wealth of sunshine, considerable moisture from sea and mountains, and a goodly store of subterranean water, but is not drought-proof, and may eventually be obliged to irrigate certain of its lands. However, six years of work at Chino have proved the possibility of raising big crops of rich beets there in an average season, and that the wiseacres who insisted that proper culture was practicable only in a temperate climate were greatly mistaken. Therefore, unless other difficulties arise, the Chino and Los Alamos plants—each 30 odd miles from Los Angeles—are the nucleus of what is destined to become a big sugar producing district.

Meanwhile, New Mexico is running after California's laurels. Last season, at Eddy, the average sugar and purity of the beets were unprecedented, and with abundant water supplies for irrigation purposes and sunshine 300 days in the year, the pioneer manufacturers in that territory firmly believe that they have found the ideal section of the United States for beet culture.

A new 500 ton plant is talked of at Roswell, 75 miles north of Eddy, and as soon as the country thereabout becomes a little more thickly populated, there is every reason to believe that beet sugar will be a staple product of New Mexico.

In Utah further development will probably be quite slow. There is plenty of land in the valleys, and that irrigation would render suitable for beet culture, but lacking, as it does, the continued sunshine of the South, it is still questionable whether the application of water in this way can be so regulated as not to keep the sugar and purity down to a rather low point.

Nebraska, also, is not likely to show rapid or immediate progress in the industry. Drought and the lack of sufficient surface water to make irrigation practicable debar a considerable portion of the State from profitable agriculture, and, while eastern Nebraska has some very fine sections of land that in a normal year can be depended upon for crops that will compare favorably with Europe, the general results have not been good enough to warrant anything but most cautious progress. Two of the most desirable sites are now looking for a factory, and if such a one were built of not less than 500 tons capacity, it could, without doubt, be made to pay well.

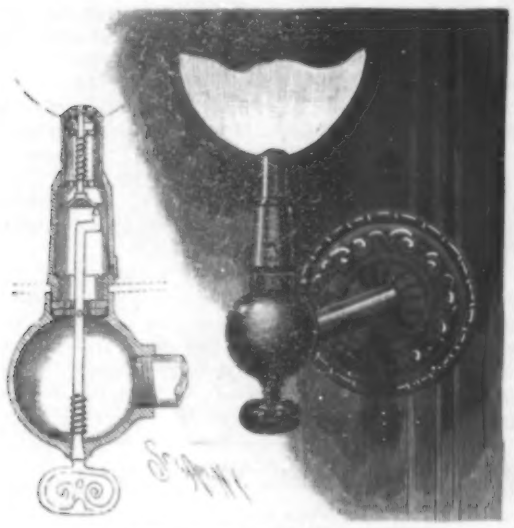
To sum up, therefore, the future of the industry in California and New Mexico is quite rosy; in Nebraska and Utah it is somewhat problematical, though by no means dark; while New York, being about to engage in its first practical test, is as yet hardly a fit subject for prophecy. It may be said in its favor, however, that it seems to have an abundance of good beet land, climatic conditions that are all right, if rains are not too heavy at harvest time, a class of farmers that are more used to the intense culture that the beet requires than those west of the Mississippi, and, lastly, very cheap coal and other important supplies.

So far as other States of the Union are concerned, several of them promise well, judging by the reports from agricultural experiment stations and test patches of farmers—Iowa, Minnesota, Michigan, South Dakota, Indiana, Colorado, Washington and Arizona having shown very satisfactory analyses. None of these, however, is likely to enjoy any immediate boom as a sugar State.

The eyes of capitalists are, for the present, turned upon California and New Mexico, and until they have their quota of beet sugar factories, it looks as if the progress of the industry in other States would be slow, unless local capital takes the thing in hand, as has been the case in Utah and New York. In other words, while the industry is bound to develop, and develop with as great rapidity as proper caution will allow, the capitalist who has half a million dollars or so to invest in a beet sugar plant will naturally choose what seem to be the most favored spots, so long as they last, and profit by the pioneer work of others, rather than undertake it himself.

AN IMPROVED GAS BURNER.

The illustration represents a gas burner provided with an automatic gas stop or cut-off, whereby, should the light be accidentally extinguished or blown out, the cut-off will immediately stop the flow of gas. It is also provided with a controller to gage the size of the light, and means for locking the fixture so that it cannot be used for unauthorized purposes. The improvement has been patented by Horace W. Billington, of No. 565 Jersey Avenue, Jersey City, N. J. The base of the burner is spherical, on this portion being



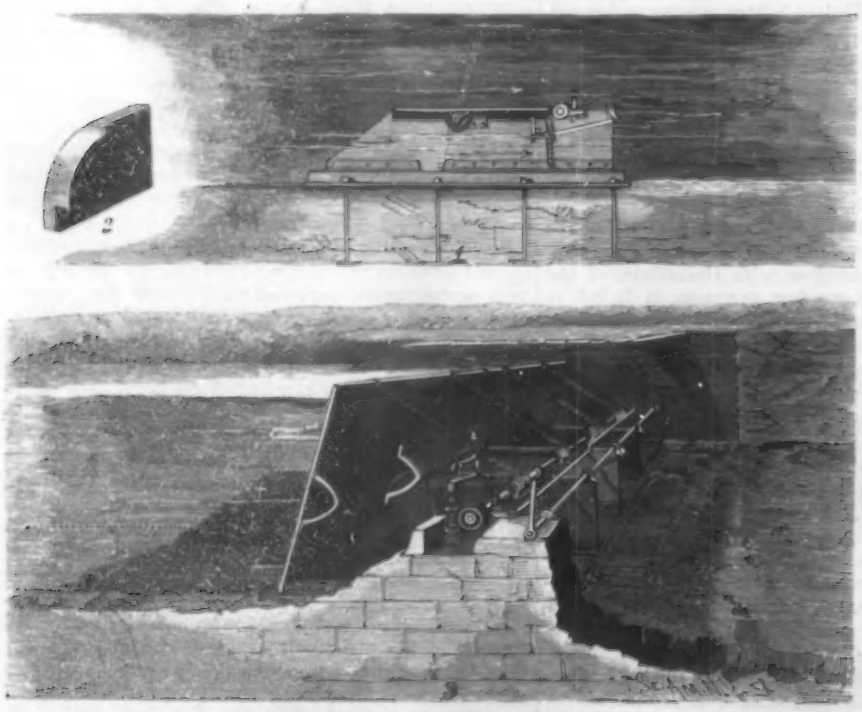
BILLINGTON'S GAS BURNER.

screwed a neck, with which the tip is removably connected, the hollow base where the gas first enters forming a receptacle to receive and hold all impurities, which may be cleaned out occasionally through an opening at the bottom. In the portion of the neck which joins the lower part of the burner is a fixed perforated disk, whose openings correspond with similar perforations on a lower revoluble disk on a rod or key, on whose lower end is a turning knob, while on the upper end of the rod is a crank whose upright member is finely pointed, and adapted to engage one of several apertures in a locking disk, as indicated in the sectional view. A spring attached to and coiled around the key rod is also attached by its other end to the inner surface of the hollow base. In the lower portion of the tip is secured a spider, through which and through an upper guide spider a hollow rectangular copper rod extends upward to the inner face of the burner tip, where it is connected with the apertured cap, a spring around the rod bearing against the two spiders, and the lower end of the rod being connected with the apertured locking disk, preferably made of steel. When the key is turned to bring the cut-off disks in registry and the gas is ignited, the copper rod is expanded, bringing the locking disk downward, so that the fine point of the crank arm of the key rod will enter one of the apertures of the disk, and the key will thus be held open, the locking disk thus also forming a controller to gage the flow of the gas. Should the flame be accidentally extinguished, the cooling of the copper rod and its consequent expansion, assisted by the spring within the tip, causes the lifting of the locking disk and the freeing of the key, when the cut-off disks move to non-registering positions, and prevent the further flow of gas. Provision is made to lock the fixture against unauthorized use, by means of a spring and a corresponding opening in the meeting faces of the cut-off disks, it being thus possible to turn the lower disk by means of the key to a locking engagement, such lock being released by passing a rod of the necessary shape through an opening in the neck portion of the burner to depress the spring.

AN IMPROVED AUTOMATIC WEIR.

The illustration represents a weir arranged to open and close automatically according to the amount of water passing down the waterway, to always retain the desired amount of water and permit a ready discharge of the surplus. Between suitable side abutments, and on top of a foundation in the bed of the waterway, are secured longitudinal I beams, the space between being filled in with cement or concrete, and on each of the beams a vertical rib is fastened by angle irons. A series of gates extend across between the abutments, rearwardly inclined and normally resting with their lower edges on the bottom of the weir, each gate having in its lower portion one or more slots adapted to straddle the vertical ribs. The gates are mounted to swing at the rear on a series of curved rider plates, one of which is shown in Fig. 2, these rider plates being bolted to opposite sides of each vertical rib, and there being also on top of the ribs horizontal angle irons, forming a rest for the gates when they curve from a vertical to a horizontal position. On the back of each gate is a reinforcing plate, adapted to ride on the rider plates, and the gates carry keepers, which inclose the rider plates, preventing the accidental displacement of them. If the height of the water to be retained is equal to the height of the gates, they press, with about one-third of their height from the bottom edges, against the rider plates, as shown in Fig. 3; and if the height of the water increases beyond the limit, the pressure on the upper portion of the gates causes them to turn on the rider plates, the gates opening proportionately to let one-half of the surplus water over the top edges of the gates and one-half under the bottom edges, as shown in Fig. 1. The gates change their resting point on the rider plates, moving upwardly and rearwardly, according to the pressure of the surplus water, and when this has been discharged and a normal pressure again prevails, the gates return to their first position.

To facilitate opening the gates when water is not desired, their upper ends are connected by chains with drums on a transverse shaft at the rear, the shaft having at one end a bevel gear with a worm on a vertical shaft to be turned by a handle. The several drums are locked to the shaft by clutches, which may be moved into and out of engagement with the drums by transversely sliding rods connected with a link under the control of a gateman on one of the abutments. When the gates move to a horizontal position, hooks on their upper ends engage pins on the vertical ribs, and the hooks may be disengaged by rods sliding on the ribs, and pivotally connected with arms on a shaft in brackets attached to a runway or gang plank, extending from one abutment to the other in the rear of the gates, one end of the shaft having a lever, by which the gateman may simultaneously throw the several hooks to unlock the gates and return them to the normal upright position. The main principle in the construction of this weir is that it is designed to retain the water to the full height of the gates when the pressure is in equilibrium, the weir commencing to discharge when the water rises above this point. The point of support of the gates changes according to the height of the water, and the gates come back again to their lowest resting point on the rider plates when the excess of water is discharged.

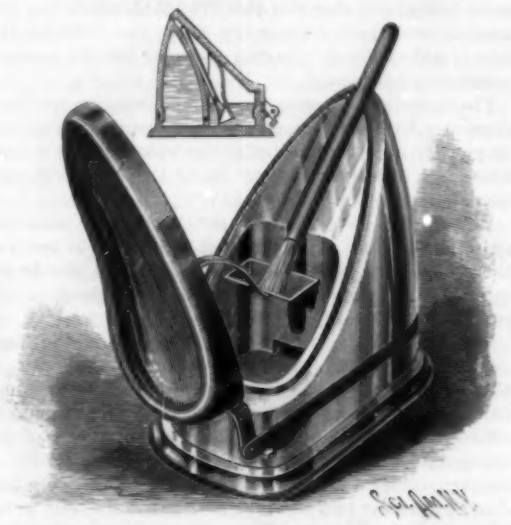


FUCHS' IMPROVED AUTOMATIC WEIR.

This improvement has been patented by Mr. G. Ludwig Fuchs, of Meiningen, Germany, and further information relative thereto may be obtained through Mr. Ernesto Fuchs, Ciudad Lerdo, Mexico. The construction of the weir is especially adapted for streams, rivers or creeks where water is to be retained to a certain level for hydraulic power or for irrigation purposes. It is also designed for use in rivers where large amounts of ice or floating obstructions may injure a weir, in which case it is provided in front of the ribs with a grate that allows the gates to perform their action without allowing any obstructions to go underneath the lower part of the gates, but forcing such obstacles to go over the weir without causing injury to its construction. Where sudden floods come, the gates work automatically to release the surplus water without the supervision of a gateman, and the practical working of the weir is designed to keep the river bed clean, as in floods all the sediment, which would accumulate before a dam made of mason work, is carried down.

A COVER FOR MUCILAGE RESERVOIRS.

The appliance shown herewith is especially designed for use with bottles having a vacuum reservoir within which the liquid is retained by air pressure, a fount or cup being connected with the reservoir by a passage at the bottom. The improvement has been patented by Truman S. Lewis, of Waterbury, Conn. (Box 823). The larger view shows the device with the cover thrown back, the small figure showing it in section with the cover closed. A connecting passage opens from the bottom of the reservoir into a well or cup in front, and the cover is pivoted to a band which surrounds the lower portion of the bottle, the lower portion of the cover having a projecting arm to engage the side of the bottle, and keep the cover from being thrown too far back. On the inside of the cover is an outwardly extending downwardly bent arm carrying a small bucket or cup, which is immersed in the mucilage when the cover is down, and on the inner side of the reservoir is a groove adapted to receive the handle of a brush placed in the cup. When the cover is thrown back, as shown in the main view, this cup then acts as a brush wiper, but when the cover is closed the brush is kept constantly immersed, with the cup, in the mucilage, so that the evaporation is not great, and the brush and



LEWIS' COVER FOR MUCILAGE RESERVOIRS.

its supporting cup are constantly kept moist, preventing the edges of the reservoir and brush from becoming gummed up.

The World's Production of Coal.

The following table has been compiled by Dr. E. W. Parker, of the United States Geological Survey, giving the coal output of the principal countries for the years nearest 1896 for which figures could be obtained. The table will appear in the Report of the Survey for 1896. The long ton is, of course, 2,240 pounds and the short ton 2,000 pounds.

Country.	Usual unit in producing country.
Great Britain (1896), long tons	196,861,360
United States (1896), long tons	171,416,390
Germany (1896), metric tons	112,437,741
France (1896), metric tons	29,310,892
Austria-Hungary (1895), metric tons	23,654,777
Belgium (1895), metric tons	21,213,000
Russia (1896), metric tons	9,079,138
Canada (1896), short tons	3,743,034
Japan (1895), short tons	3,400,000
India (1895), long tons	4,441,890
New South Wales (1896), long tons	3,737,536
Spain (1896), metric tons	1,878,399
New Zealand (1894), long tons	719,546
Sweden (1895), metric tons	223,652
Italy (1895), metric tons	305,321
Transvaal (1895), long tons	1,152,206
Queensland (1895), long tons	322,977
Victoria (1895), long tons	194,171
Natal (1895), long tons	153,951
Cape Colony (1895), long tons	87,985
Tasmania (1895), long tons	36,856
Other countries	2,000,000
Total in English tons	569,732,000
Percentage of Great Britain	33·1

The total under "other countries" includes China, Turkey, Servia, Portugal, United States of Colombia, Chile, Borneo and Labuan, Mexico, Peru, Greece, etc.

MOULDS FOR SOLDERING PIPES.

The apparatus represented in the accompanying figure consists of a bronze mould formed of two pieces opening through a hinge, and which is fitted either horizontally or vertically to the extremities of the two lead pipes that it is desired to solder together. For vertical pipes a special hopper is provided. It is necessary to scrape and carefully prepare the extremities of the pipes to be united. Then the mould is heated and fixed to the latter. After this the molten lead, which has been raised to a red heat, is poured in. In this way there is obtained a very clean joint without any burrs. It is to be remarked that only lead is employed, instead of the soft solder used with the soldering iron and lamp.

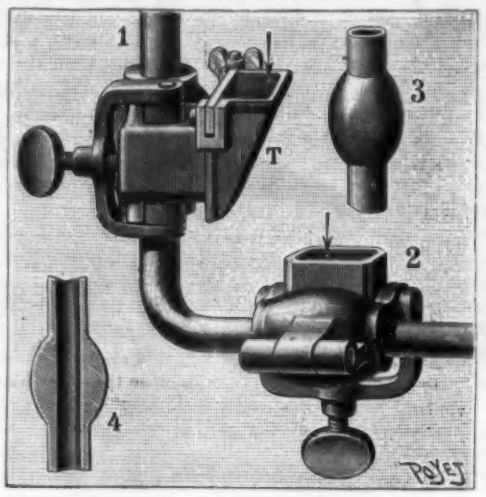
These moulds, due to M. Tye, permit of soldering more rapidly and surely than with the ordinary process, and of effecting a considerable saving, resulting from the difference in the cost of the material and diminution in manual labor. These apparatus are made in several series, varying according to the external diameters of the pipes. They can be arranged for uniting pipes of different diameters and for soldering two pipes at right angles, and either horizontal or vertical.—La Nature.

BORING OIL WELLS AT SEA.

The early settlers in California were familiar with the indications of oil, which were common at various localities up and down the coast, and the asphaltum from beds in the sea, where this product oozed up out of the bottom, formed an important factor in the household economy of the ancients. In almost every burial place on the coast asphaltum is found. The natives employed it to mend objects which were broken, and as a base in which to place ornamental pieces of pearl mosaic; baskets were fastened to ollas by this means, and it was used for endless purposes in lieu of nails, cordage and glue. The natives on the islands obtained their supply from the water, and today the rocks at various places can be seen splashed with asphaltum which has drifted in. This is particularly noticeable after an east wind, showing that there is a large area in the deep Santa Catalina channel from which asphaltum oozes up. Off Redondo Beach, Los Angeles County, it is extremely troublesome, oozing out of the sand offshore and drifting in. Between Santa Monica and Los Angeles there are undoubted deposits, and north of Santa Barbara several enormous ones. That owned by the More estate extends some distance alongshore, so that vessels run in and the asphaltum is shoveled aboard. The quality, it is said, is quite equal to that of the famous Trinidad variety.

At Santa Paula, oil wells were long ago developed, and later the oil-producing belt was found at Puente, and again at Summerland, below Santa Barbara, where a singular state of affairs may be seen. That the oil-bearing strata reached out into the ocean soon became apparent at Summerland, and the drill scaffoldings, looking like windmills without the wheel, began in a short time to extend down the little cañon which they had filled and to creep up the shore in the direction of Santa Barbara. At first, as shown in the accompanying illustration, they kept along the sides of the hills which breast the ocean here, but gradually they turned seaward, until one more adventurous than the rest rose from the water. The work was started at extreme low tide, and finally the tall scaffolding appeared twenty or thirty feet from shore, seemingly rising from the sea.

The illustration shows the location of three wells, which at low tide are in the water and at flood tide are



MOULDS FOR SOLDERING PIPES.

completely surrounded, the men working on platforms of various heights which they ascend when working as the sea rises. The structures that are built in the sea have not yet experienced a strong southwester, and it is assumed by some that there will be a fall in oil when a heavy sea begins to break against the scaffolding. The drill is worked in the water by an engine on the beach, the fuel being the oil pumped up; this engine working several wells. At present the most daring well scaffold stands in six feet or more of water at high tide, and there is rumor that others will be pushed out into the shallow water near the kelp beds. This is probably the only place where oil is pumped out of the ocean. Undoubtedly the entire coast in this vicinity overlies an oil-producing stratum. Off what is known as More's wharf, half a mile out, oil rises to the surface in several places. A spring of water also rushes up here with such velocity that it can be taken up and used if one does not mind a slight intermixture of salt. A similar spring is known on the Florida coast, where it is said that a vessel can lie alongside the great rush of water and fill her tanks with fresh drinking water out of the ocean.

Probably one of the most extraordinary sights of oil wells is seen in Los Angeles. Oil was first discovered in the west portion, in what was considered a choice residence part of the city, but like magic the lighthouse-like scaffoldings began to rise until the land appeared fairly to bristle with them. Fine residences were ruined by the proximity of the unsightly objects, and, finally, the section was given over to them, and now resembles certain sections of the oil region in Pennsylvania. See the SCIENTIFIC AMERICAN for July 17, 1897.

The wells have advanced in a well defined tract in a northeasterly direction, and at present appear to be stopped by the large Catholic cemetery, which overlies the oil-producing strata. Not far distant is the Los Angeles River, which probably will ultimately be encroached upon and made to give up its hidden riches.

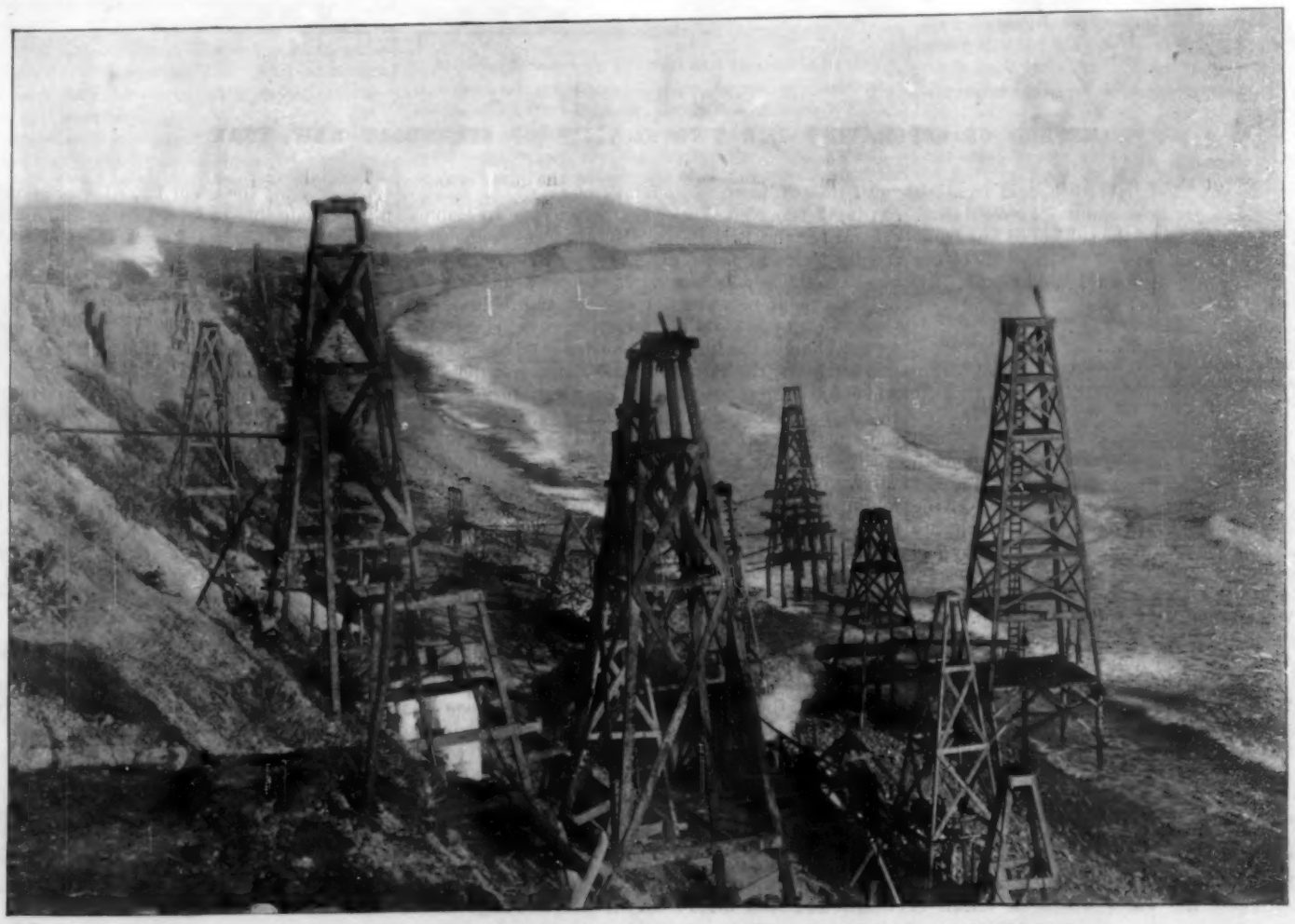
The discovery of oil in and about Los Angeles bids fair to revolutionize certain lines of business, and promises to produce the long wished for power for manufactories. The Terminal Railroad has adopted the oil as fuel, and the Southern Pacific is said to be experimenting in the same direction.

California is without deposits of coal, if we except lignite beds, which crop out in various places, so that oil, as fuel, will supply a long felt want, and become a factor in the rapid development of this growing city.

Reported Discovery of Strontium.

The discovery of a large bed of strontium at Put-in-Bay Island, reported from Toledo, has awakened a considerable amount of interest among the manufacturers of fireworks, as it is thought likely that it will result in a considerable reduction in the price of all fireworks in which strontium nitrate or strontium carbonate is used. One large manufacturer of fireworks in New York, who makes use of about one hundred and fifty tons of strontium nitrate in a year and imports the whole of it from Europe, states that it costs his firm now about seven and a quarter cents a pound. If the strontium should be found in large quantities, it would have the effect of lowering the cost of certain classes of fireworks, that is, all those that use a red or crimson light. At present the supply comes chiefly from Germany, and the American manufacturer has to pay a high price for it.

ON the approach of a thunder storm French peasants often make up a very smoky fire, says Industries and Iron, in the belief that safety from lightning is thus assured. By some this is deemed a superstition, but Schuster shows that the custom is based on reason, inasmuch as the smoke acts as a good conductor for carrying away the electricity slowly and safely. He points out that in 1,000 cases of damage by lightning 6·3 churches and 8·5 mills have been struck, while the number of factory chimneys has only been 0·3.



OIL WELLS ON THE SEA SHORE NEAR SANTA BARBARA, CALIFORNIA.

LENGTHENING A HUDSON RIVER STEAMBOAT.

(Continued from first page.)

freight, have no sleeping accommodation, and are built with the sole object of giving the traveler a swift passage with every possible facility for seeing the beauties of the Hudson River. As compared with the night boats they sit low in the water, and one misses the towering superstructure, the dining saloons, parlors, etc., being all contained on the main and upper decks. They are distinguished by the extreme fineness of their lines and a general rakish and yacht-like appearance that is not belied by the speed of 23 miles an hour of which they are capable under favorable conditions.

The twin boats of the Albany Day Line were built with the object of enabling the tourist to leave New York at a reasonable hour in the morning and reach Albany in the early evening; or, should he prefer it, to make the round trip between New York and Poughkeepsie between nine in the morning and half past five in the evening. As the distance is 150 miles, and the current varies from one to two and a half miles an hour and seven different landings have to be made en route, the actual speed of these boats has frequently to be maintained at 20 miles an hour to enable them to make the run within the nine hours. This large reserve of power enables them in cases of emergency or delay to run up to 23 miles an hour, and herein lies the secret of the remarkable regularity with which the landings are made. This is seen at Poughkeepsie, where the passengers that are making the round trip are timed to land five minutes before the arrival of the return boat from Albany. The transfer is made with unfailing regularity.

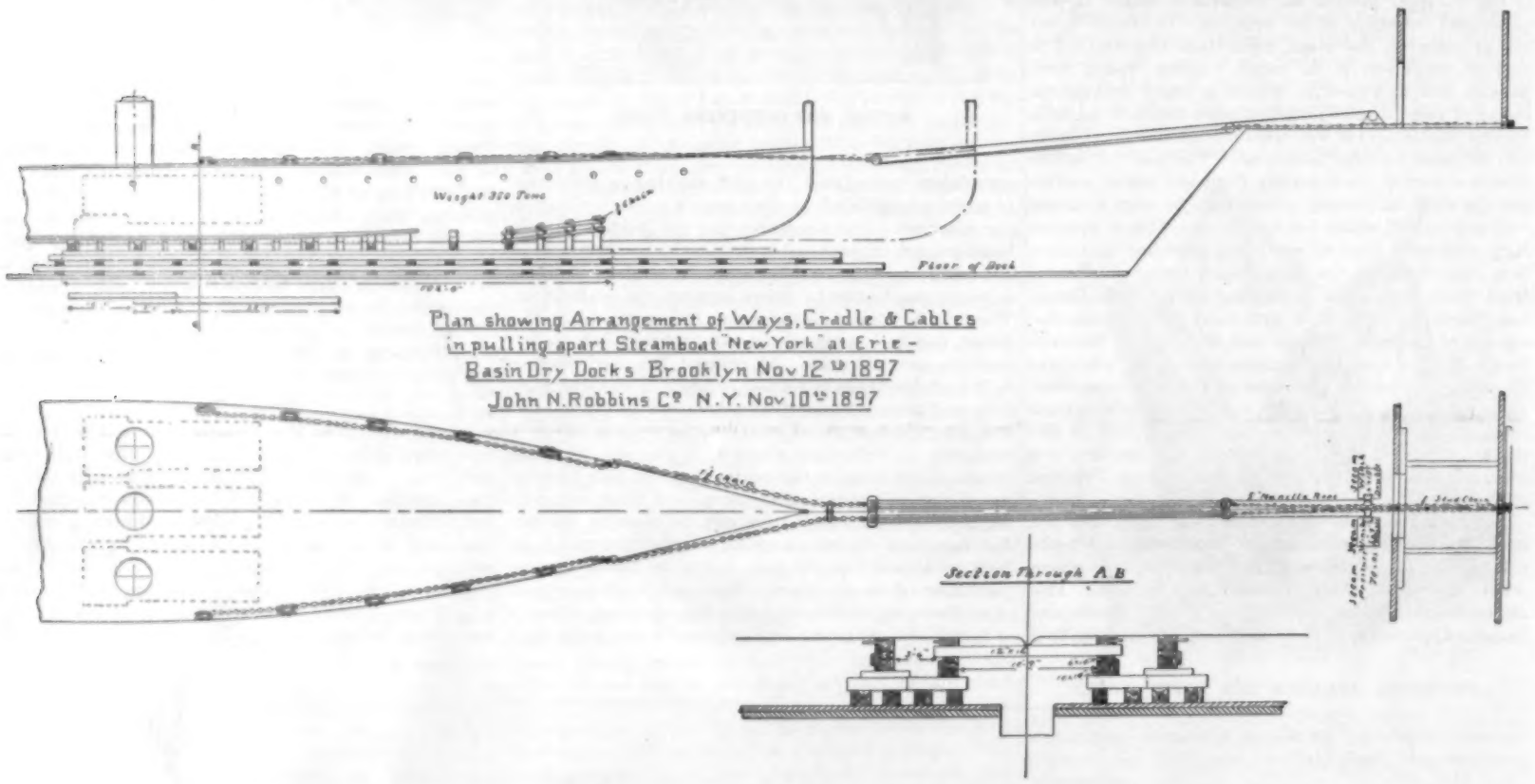
The New York, which forms the subject of our front page illustrations, was built in 1887 at the yards of the Harlan & Hollingsworth Company, Wilmington, Del. Her dimensions are as follows:

Length on water line	301 feet.	
Length over all	311 "	
Breadth of beam, moulded	40 "	
Breadth of beam, over guards	74 "	
Depth, moulded	19 "	8 inches.
Draught	6 "	
Tonnage (net [illegible])	1,592	

The hull is built of iron, and everything was done to cut down the weights and secure the light draught which is necessary for running at high speed over the shoals of the upper river. The frames, which are spaced 2 feet apart, are 4 inches by 3 inches by 7-16 inch; the reverse bars are 3½ inches by 2½ inches by 5-16 inch; the stringers are 4 inches by 3 inches by ⅜ inch, and the floors 16 inches by ⅜ inch. The shell plating is ⅜ inch throughout, except the sheer strake and garboards, which are ½ inch and 7-16 inch respectively. The hull is divided into four watertight compartments by bulkheads, which extend to the main deck and are free from doors or passageways, the compartments being entered by stairways from this deck. The boat is driven by a standard American beam engine of 3,850 horse power, with a cylinder 75 inches diameter by 12 feet stroke, provided with a Stevens cut-off. The 30 foot paddle wheels are of the "feathering" type, in which the steel buckets enter and leave the water perpendicularly, and thereby avoid that beating of the water which, in wheels of the radial type, at once absorbs much of the engine power and sets up an uncomfortable vibration in the boat. Steam is supplied by three return-flue boilers 9¼ feet diameter and 33 feet long.

As the boat is designed for giving full opportunity to see the beauties of the river, the saloons and private parlors on the main and upper decks are liberally supplied with glass, the partitions between the windows being kept down to the lowest practicable limit. A special feature, borrowed no doubt from the railroad observation car, is a set of private observation parlors, located just forward of the paddle boxes, the fronts of which consist of large plate glass bay windows, which reach from the ceiling almost to the floor. Taken altogether, the New York, with its long unbroken lines of hull and superstructure, its double row of continuous plate glass windows, its shapely paddle boxes, and its pale, buff-colored smokestacks standing three abreast, is as dainty and picturesque a piece of naval architecture as can be seen anywhere in American waters.

The sister ship, the Albany, which was built in 1880, was lengthened 30 feet during the winter of 1892, and the results were so satisfactory that the company recently determined to make the same addition to the length of the New York. The operation of cutting the hull of a vessel in two, hauling it apart, and building in a new section at the point of division, is a delicate operation that calls for the best skill of the shipbuilder. The Albany was sent down to Wilmington to be lengthened; but it was decided that the local shipyards were quite equal to a task of this kind, and accordingly the New York was taken over to Robins' shipyard at the Erie Basin. Here she was floated into the dry dock and placed upon the keel blocks and bilge blocks in the usual manner. It was decided to cut the hull at a point between the engines and boilers, and the first step was to build launching ways beneath the forward half of the hull, and transfer to it the load that was carried by the blocks. The accompanying diagram, which has been prepared from drawings furnished by the John N. Robins Company, shows in detail the construction of the ways and the rigging of the gear with which the vessel was pulled apart. The fixed ways, which were 10 inches deep by 14 inches wide, were laid upon blocking on the floor of the dock and well shored guide pieces were spiked to the outside of these ways to keep the sliding ways in place. The latter were built of 6 × 14 inch timbers and were tied together with 12 × 12 transverse timbers at regular intervals. The space between the transverse timbers and the floor of the hull was filled in with blocks and wedges, and at the forward end shoring pieces were substituted to accommodate the decreasing width and the taper of the bow. The length of these ways was 102 feet, and they were placed 10 feet 9 inches apart in the clear. At a distance of 3 feet 9 inches on the outside of the main ways, a pair of additional ways were built to take the weight of the boilers. The rubbing surfaces of the ways, which of course were planed and smoothed, were freely lubricated with a mixture of tallow and fish oil. When everything was completed, the wedges were gradually driven home until the weight had been lifted from the keel and bilge blocks and was carried entirely by the ways. The pulling apart of the hull was accomplished by means of four 1⅜ inch chains, a pair of 5 inch manila ropes working in fourfold blocks, and a couple of steam winches located at the head of the dock. A chain was led through the hawse hole on each side at the main deck and wound around four successive bitts so as to secure a thorough distribution of the strain. Just in front of the stem they were lashed together, and made fast to a pair of fivefold blocks. The inshore blocks were connected to 1⅜ inch chains, which were led back through one of the dock buildings and secured to a 12 × 12 stick of timber placed on the outside of the building at the ground level. The falls of the tackles were led to a pair of steam winches. In cutting apart the iron hull, all that was necessary was to cut off the rivet heads and knock out the rivets. This was done in every case at the original butts. The three decks, partitions, guards, and sponsons, were then sawn through and everything was now ready for the pull. At a given signal the forward half of the boat, weighing 350 tons, began to move slowly and steadily forward, and in exactly 5 minutes and 30 seconds it was stopped precisely at the measured mark, thirty feet ahead on the ways. Mr. W. D. Dickey, the superintendent of the Dry Dock Company, stood on the floor of the dock under the bow and directed the enginemen at the winches by signal what was to be done. When the two portions of the boat were lined up with fine piano forte wire, it was found that one side of the bow had to be raised only ⅛ of an inch and the stem jacked over about an inch—a highly creditable result. During the building of the ways, the fifteen frames for the new section of the hull had been made in the shops to model. The work of carrying them into the dock and putting them in place was done by hand, as shown in the engraving. It commenced on Saturday morning, and by noon of the same day the work was in frame. The framing and plating is similar to that of the rest of the hull, with the exception of two additional sister keelsons of ⅜ inch plate, which are spaced about 16 feet apart.



Plan showing Arrangement of Ways, Cradle & Cables in pulling apart Steamboat "New York" at Erie-Basin Dry Docks Brooklyn Nov 12th 1897
John N. Robbins Co. N.Y. Nov 10th 1897

METHOD OF SEPARATING THE TWO SECTIONS OF STEAMBOAT NEW YORK.

The owners of the shipyard are to be congratulated on the rapidity and success with which this novel and difficult piece of work was done. The work of cutting the rivets was started at 1 A. M. Thursday, November 11, and completed that night. The ways were completed by 3:30 P. M. on Friday, and the hull was in frame by noon on Saturday, the total working time being 17½ hours. It is expected that within 15 days from the time the boat was docked, the new hull and the main deck work will be completed.

It is estimated that the additional buoyancy afforded by the new section of the hull will lighten the draught by 5½ inches. This, on a model of such great beam and fine lines as the New York, will give her an easier waterline and will, if anything, increase her speed. However, as the lengthening was undertaken with a view to increasing the passenger accommodation, which at present is 2,500, it is probable that with a larger load the speed will remain at 23 knots with forced draught or 20 knots under ordinary working conditions.

Correspondence.

Increase of the Artillery Force.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the article upon sea coast defense in your number of November 13, in which mention is made of the large number of men required to man the guns which will be required, your correspondent begs leave to make the following suggestion:

After retaining at each post the minimum of regularly enlisted men necessary to keep the armament in order, let the full fighting force required be enlisted in the vicinity under the following conditions:

The men to serve, with pay, for a stipulated time each year, during which time they will be instructed in their duties. During the remainder of the year, except in time of war, the men to remain at their homes, without pay, subject to call when needed.

By selecting the time of service when little labor on the farm is required, an abundance of the very best material would be secured, men who would be glad to remain in the service for years, and who would be available at any time on a day's notice.

Such a force would be brought under the best possible influences for making them do their duty gallantly, for they would be fighting directly in defense of their homes under the very eyes of their friends and neighbors.

While the efficiency of this service would be equal if not superior to any other, the cost would be far less, and the money expended would go into the pockets of thrifty, worthy people, where it would do the country some good.

A similar plan is now followed in the life saving service, the men serving, on pay, for certain months of the year only, and where could a finer body of men be found than these? WM. W. BLACKFORD.

Lynnhaven, Princess Anne County, Va.

Organized Arctic Exploration.

To the Editor of the SCIENTIFIC AMERICAN:

In the number for September 25 of your valued paper I find a note on Mr. W. Wellman's proposed polar expedition.

Mr. Wellman's plan in so far coincides with what I have long considered to be the only rational solution of this problem that I am encouraged to offer a few general suggestions that may, perhaps, elicit a broader discussion of this interesting subject.

I quite agree with Mr. Wellman that up to this time all attempts to reach the north pole were dashes. Therein, in my opinion, lay the ultimate cause of their failure. I am certain that if half the energy, patience and money spent in organizing polar expeditions in this century had been applied to systematic advance, the north pole would have been reached many years ago. I shall not spend time in analyzing the psychical motives that led Franklin, Dr. Kane, Peary, Nansen and all the host of polar explorers to prefer individual feats of nearly superhuman exertion to a steady and, possibly, international action in this direction. Very probably the main reason can be found even in Mr. Wellman's words: "I am eager . . . to plant the American flag," . . . etc. The world at large has gained very little by following this plan, and many brave men and valuable lives have been sacrificed without any real necessity.

When we come to think quietly over the matter, it is difficult to see any necessity in reaching the north pole at a jump. In all probability, if even the jump is successful, the happy individual who succeeds in alighting on the spot "whence there is no direction but south," will be so utterly exhausted by the terrible strain of his feat that he will have no more energy left for steady exploration and observation that can alone be of any real use to science or humanity. All the remnant of his courage and physical endurance will necessarily be employed in attempting to jump home again.

Mr. Wellman's plan seems to me the first step in the true direction; unfortunately, I see in the plan as it now stands two elements that can bring on failure where success should be certain. One of these elements is haste and the other national and personal egotism. If, instead of fixing a term of three years, Mr. Wellman had not put any limit to his work, and if, instead of packing up only the gallant "stars and stripes," and refusing "public subscription and universal consent," he would take the international flag "Excelsior" and accept both universal subscription and universal consent, his ultimate success would, I am confident, be a matter of certainty and not of doubt. Private means and private energy may, certainly, cover the expenses and furnish the exertions of founding two or three supply stations and undertaking a three years' expedition toward the pole, but they can hardly suffice to bring that enchanted spot within the reach of continuous scientific research.

I think that the north pole should be and can be reached only by a continuous chain of stations, placed "not two or three degrees," i. e., 30 or 45 geographical miles, apart, but within an easy day's journey from each other; say at a distance of 15 or 20 kilometers. At intervals of a week's march, say at every 100 or 120 kilometers, a large depot should be constructed, where a party of 10 or 12 men and 60 dogs could live comfortably for months at a time, if necessary. The intermediate stations could be much simpler equipped, and consist of a warm shanty, with a sufficient supply of provisions and fuel to allow a party to stay over a blizzard or even a few days of exceptionally inclement weather. All the stations should be connected by a telephone line, made strong enough to insure continuous service. This line would serve also as a guide rope from station to station.

If the point of departure be Cape Flora, as proposed by Mr. Wellman, ten degrees from the pole, or about 1,200 kilometers, ten large depots and fifty smaller stations would bring the pole into constant communication with America or Europe, provided Cape Flora can be regularly reached by shipping. If not, one or two intermediate large stations should connect Cape Flora with some open port.

The cost of such a "road to the pole" would certainly be very considerable (some of the stations may possibly have to be solidly constructed house boats, heavily anchored in the open sea), but that cost will scarcely be greater than that of a first class overland railroad of the same length, and certainly not beyond the limits of international enterprise and international wealth.

The time needed to construct such a chain of stations may be ten years (at the tortoise speed of 120–150 kilometers a year) instead of three, but really, ten years are a short time for inevitable success in comparison with the seventy or eighty years already spent in more or less heroical failures. N. THISHKOV.

Timbirsk, Russia.

Miscellaneous Notes and Receipts.

The Uses of Chrome Glue Especially as Glass Cement.—Chrome glue is known to consist of a moderately strong gelatine solution (containing 5 to 10 per cent of gelatine) to which about one part of acid chromate of potassium in solution is added to every five parts of gelatine. This mixture possesses the property of becoming insoluble by water through the action of sunlight under partial reduction of the chromic acid, a property which is advantageously utilized in photography. The author coated both fractures of a glass as uniformly as possible with the freshly prepared solution, pressed them together, and fixed them in this position with a cord. The cylinder glass was exposed to the sun light and was found to be firmly united after a few hours. Even hot water did not dissolve the oxidized chrome glue, and the fracture was scarcely noticeable. Valuable articles of glass, which would be disfigured by a thick cement joint, can be very nicely repaired in this manner.

In the production of waterproof textures chrome glue is likewise of use; at least, where a certain tightness is no drawback. The fabric, after having been put in a frame, only needs to be painted one to three times with the hot chrome glue and then to be exposed to the sun light or day light.—Prof. Schweizer, in Textil Zeitung.

Mode of Preserving Flowers and Grasses.—In drying flowers and grasses, which are to retain their fresh colors and natural shades, proceed as follows: Take a box with a sliding cover, remove the bottom and immediately below the lid (inside the box) attach a medium fine wire sieve. Procure fine, clean sand, sift off the dust, wash out the sand and dry it at moderate heat. Then warm the sand again in a copper kettle and after it has become hot enough add one-half part (weight) finely scraped stearine to one hundred parts (weight) sand: this is mixed and intimately incorporated with the sand, so that each grain receives a coating of stearine. Cut well developed specimens of flowers or ornamental grasses, place the box with the sliding cover and sieve downward, put in a layer of sand about two inches high, stick the flowers, etc., into this and cover them gradually with sand, but in such a manner that the stems and leaves retain their natural position. Thus continue with alternating layers until the box is filled, then put on the bottom carefully and set the box in a warm place, which must not be too hot. After about forty-eight hours drying is finished, the box is taken down and the sliding cover pulled off carefully; the sand will fall through the sieve and the flowers, grasses, etc., remain dried in their natural shapes and colors.

Production of Printing Inks.—(a) Warm 4·5 parts Venetian turpentine with 2 parts oleic acid as free from stearine as possible, adding 5 parts soft soap. Then add 3 parts of burnt, finely sifted lampblack and a solution of 0·1 part Paris blue and 0·1 part oxalic acid in 5 parts water. (b) 9 parts Venetian turpentine, 10 parts soft soap, 4 parts oleine, 4 parts lampblack. (c) Melt together carefully 25 parts paraffine oil, 45 parts colophony at 80° (176° Fah.), and add 15 parts lampblack. (d) For web printing presses use only 30 parts colophony instead of 45 parts. (e) For perquisites use dammar resin instead of colophony.—Pharm. Zeitung.

Science Notes.

The steamer Warrimoo, from Australia, brings advices as follows: H. M. S. Penguin has just returned to Fiji after surveying the proposed Pacific cable route from Suva to Honolulu. The bottom of the ocean was found to be very uneven. One or two uncharted patches near Honolulu were discovered, but, as they have seven or eight fathoms of water over them, they are not dangerous to navigation.

Sir Rutherford Alcock, K.C.B., F.R.C.S., died recently at the age of eighty-eight years. The deceased was brought up to the medical profession, but soon gave it up for travel and the diplomatic service. He was president of the Royal Geographical Society in 1876, and also presided over the health department of the Social Science Congress a few years afterward. To Sir Rutherford Alcock we owe much of our knowledge of the far East.

Twenty million dollars is the sum which the French government proposes to devote to the Paris Exhibition of 1900. Nearly $10,000,000 will be consumed by the construction of two palaces in the Champs Elysées and those in the Champ de Mars, in the Esplanade des Invalides, and on the quays. The bridges across the Seine are to cost $1,000,000, and the mechanical and electrical services another $1,000,000. In one word, France proposes to do the whole thing on a scale of unprecedented magnificence.

The World's Columbian Exposition Company must pay the loss to the French republic and French exhibitors caused by the fire on January 8, 1894. Such is the opinion of Judge Grosscup, handed down November 8, from the Federal bench. The fire at the Casino and Peristyle showered sparks upon the wooden walk of the Manufactures building. The burning timbers fell into the building and upon the exhibits of the Frenchmen. The French republic lost some fine Beauvais and Gobelins tapestries and two magnificent Sevres vases, made for ornaments at the entrance to the Chamber of Deputies. The loss amounted to about $75,000.

The Straits Times states that, according to telegraphic advices from British North Borneo, an earthquake was felt at Kudat on September 21, as also a slight tremor at several places along the coast. About the same time a new island was thrown up from the sea between Mempakul and Lambeidan, 50 yards from the mainland, opposite Labuan. The island is of clay and rocks, and measures 200 yards long by 150 yards broad and 60 feet high. The island appears to be increasing in size, and emits inflammable gas in several places, with a strong smell of petroleum gas. The earthquake was not felt at Labuan.

Experiments made in the laboratories of Sibley College show that the usual figures for dense smoke per ton of fuel employed ranged from 10 to 12 pounds of soot; of the latter, about one-half was carbon, the remainder principally unconsumed hydrocarbons, 10 to 15 per cent of ash, and, if collected outside the furnace, perhaps 2 per cent of moisture. It was found that no smoke was ever produced in an atmosphere of oxygen. With restricted air supply the maximum just stated was obtainable; but low temperature combustion and restricted oxygen supply appeared to be the two main conditions favoring smoke production. Again, the composition of soot was found often to be substantially that of the coal from which it was produced. A reduction of the proportion of smoke made effects a reduction correspondingly, and, perhaps, proportionately, in the percentage of carbon contained in the soot.

Krupp Armor Plate Process.

According to press dispatches the Krupp armor plate process is to be adopted by both the Carnegie Steel Company and the Bethlehem Company, they having purchased exclusive rights to the process in the United States. The details of the process have not been made public, but it is claimed that the plates which are produced by it are superior to those made by the Harvey process. It is said the cost of the armor under this process will be higher than under the Harvey process. The English armor plate making firms of John Brown & Company, Cammell & Company, Vickers & Company, and the French firm of St. Chamond have also purchased rights of the Krupp process.

Mount Vesuvius in Eruption.

Mount Vesuvius is more active than it has been for years, and the eruption is daily increasing in magnitude. The volcano now presents a beautiful appearance, shooting forth immense columns of smoke and ashes, through which the fire from the central crater pours upward, illuminating the showers of cinders and the lava streams. The wind carries the ashes to Naples.

Swedish Polar Expedition.

King Oscar and a number of private persons have contributed a sufficient sum of money to insure the dispatch of a Swedish polar expedition in 1898. It will be led by Prof. Nathorst, the geologist. The cost of the expedition is estimated at 70,000 crowns.

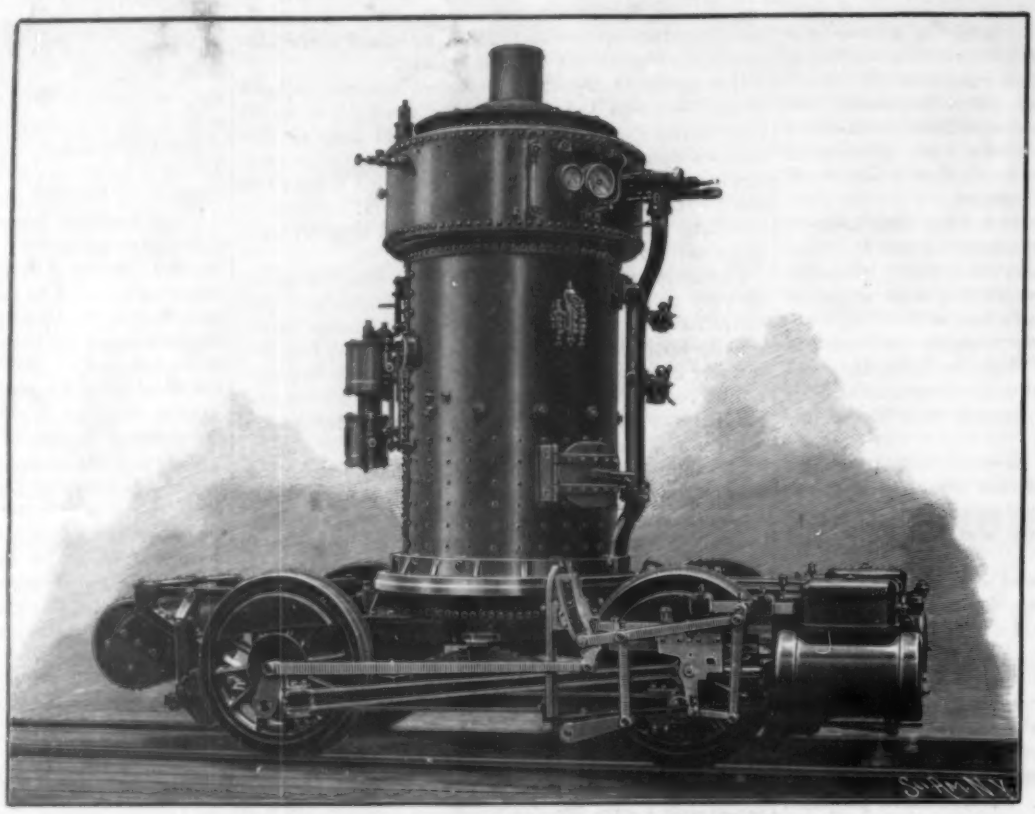
STEAM MOTOR CAR FOR BRANCH LINE SERVICE.

It frequently happens that the large railroads have branch lines on which the travel is so light that they cannot be worked to advantage by the usual locomotive and cars. On such lines, where the traffic is light and scattered, a regular train can only secure a full load if it is run at infrequent intervals—an arrangement which, though it may be to the advantage of the company, is more or less inconvenient to the public. To run a regular train at more frequent intervals would be a dead loss to the company, on account of the large dead weight of the train in proportion to the paying load, and also on account of the large train crew which must be employed. Nor would the electrical equipment of such roads be profitable, the travel being too light to warrant the cost.

It is in this particular class of service that the steam dummy, as the combined locomotive and car is called, is likely to prove extremely useful, on account of its large passenger capacity in proportion to the weight of the motor power and the size of the train crew. The composite car which is herewith illustrated has recently been completed by the Schenectady Locomotive Works for use on a branch line of the New England Railroad, where the traffic does not warrant the services of a complete train of locomotive and cars. As the first motor was somewhat in the nature of an experiment, it was decided to make use of an old dining car. The internal fittings, kitchen, tables, etc., were removed, and the car, which is 64 feet long, was divided by partitions into three compartments, one being given up to the engine and the other two constituting the smoking compartment and day coach.

The six-wheeled truck at one end of the car has been retained, but the other truck has been removed and its place is taken by the four-wheeled locomotive shown in the engraving. The cylinders, which are 12 inches diameter by 16 inches stroke, are carried at the forward end of the frame, and are connected to crank pins on the rear axle. The center of the frame is occupied by the vertical boiler, which projects through the engine compartment of the car and answers to the king pin of an ordinary truck. This connection between the locomotive and the car is an interesting feature. A circular casting, which is bolted to the engine frame and to the lower part of the boiler, is provided with a groove, in which are 125 hardened steel balls 1¼ inches in diameter. A similar casting is bolted to the framing of the car, and rests upon the circle of balls. This ball-bearing connection permits the motor to take the curves freely, and it also prevents the vibration of the locomotive from being transmitted to the car. The steam pipe connections from the boiler to the cylinders are laid on the inside of the cast iron rings, and flexible steam joints are avoided.

The furnace door is on the front of the boiler, and above it, on the upper end, are steam and air pressure gages, etc. On the opposite side is the Westinghouse air pump, the receiver being carried on the front end of the truck. The coke fuel is carried in bins within the engine room, and the water is carried in the long cylindrical tank which will be noticed slung beneath the body of the car. The car carries sufficient fuel and water for a run of sixty miles. The driving wheels are 42 inches in diameter and the driving wheel base is 8 feet. The total weight of the car is 115,000 pounds, of which 70,000 pounds are on the drivers and 45,000 pounds on the six-wheeled truck.



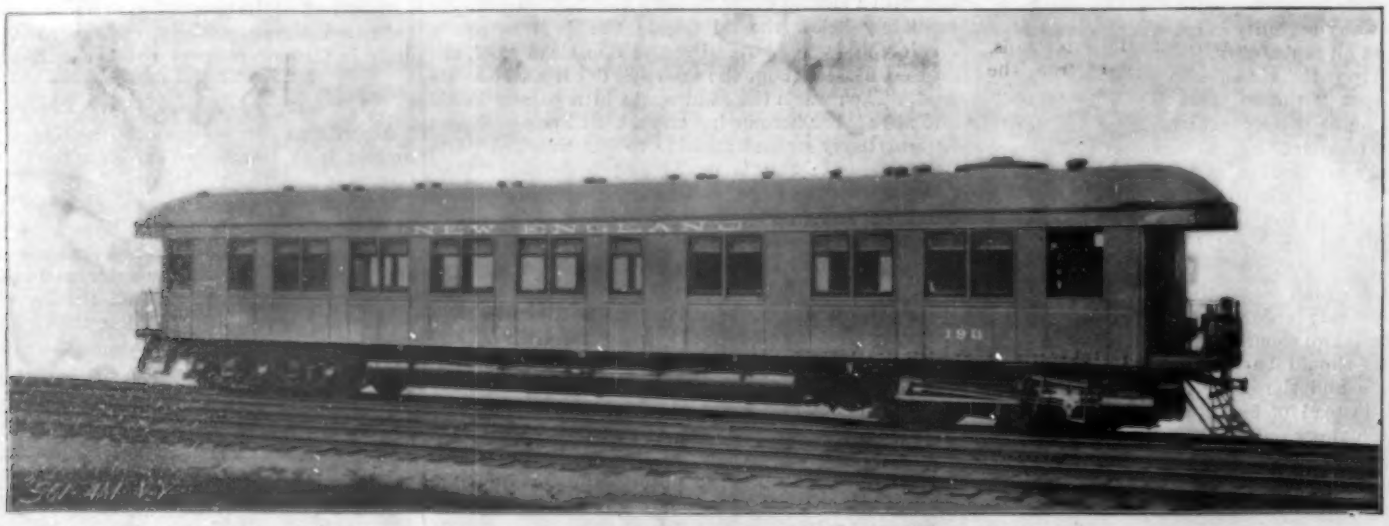
LOCOMOTIVE OF NEW ENGLAND RAILROAD MOTOR CAR.

The car was tested on a grade which varied from 50 to 58 feet to the mile, where, with a regular passenger coach attached, it maintained a speed of thirty miles an hour. A test for speed was made by running the motor car alone on a level track, under which conditions it covered five miles in five minutes and fifty-five seconds. The details of the run were as follows:

	Minutes.	Seconds.
First mile run in	1	20
Second mile run in	1	10
Third mile run in	1	5
Fourth mile run in	1	7
Fifth mile run in	1	13

The fastest mile, therefore, was run at the rate of 53·7 miles per hour.

The car was run under its own power from the Schenectady shops to its destination on the New England road, a distance of 315 miles. It should also be mentioned that the train crew consists of only two men—an engineer and a conductor. This exceedingly interesting design marks a new departure in steam railroad practice, and we shall not be surprised if it proves to be the forerunner of a large and ever-growing number of the same type of motor car.



STEAM MOTOR CAR FOR THE NEW ENGLAND RAILROAD, COMPRISING LOCOMOTIVE, SMOKER AND DAY COACH—CAPACITY, 60 PEOPLE.

A REMARKABLE thunderstorm passed over Italy on April 24. The rain was mixed with sand and seeds of the carob that must have come from Africa, according to Prof. Tacchini, of Rome.

A Tank for Model Ships.

An experimental model ship tank, for which Congress appropriated $100,000 last year, is being rapidly constructed in the Washington navy yard. It is thought the tank will be ready for experimental operations early in the spring. The project is being watched with great attention by naval officers and marine architects, as its novel features and purposes are mainly of an untried character. Similar tanks exist in England, Italy and Russia, but the American tank embraces a number of mechanical contrivances which are expected to add materially to our knowledge of hull design. The tank is four hundred and seventy feet long, and is built entirely of concrete, and will be covered by a substantial steel framed building. Spanning the water surface, a moving bridge will carry the dynamometrical device for measuring the resistance of the accurate models of vessels towed from one end of the tank to the other. These models, representing precisely the form of the ships, will be from fifteen to twenty feet long, and when towed at slow speed will furnish data upon which the efficiency of a full-sized vessel at high speeds may be determined from formulæ. The frame for the building, which is to be five hundred feet long and fifty feet high in the clear, is being delivered at Washington. The shelter is designed to enable the maintenance of a constant temperature and an absolutely still atmosphere during experimentation. The towing gear will be operated by electricity. It will be installed next March. The experimental tank at the Washington yard is the design of Naval Constructor D. W. Taylor, who is superintending its construction.

Accident to the Maasdam.

The Dutch steamer Maasdam, from Rotterdam for New York, returned to Plymouth on November 14, with her machinery disabled, arriving there without assistance, however. On November 7 the high pressure and low pressure cylinders of the fore engine broke, smashing the crank shaft, shaft frame and foundations. The accident occurred in a heavy gale. A steamer tried to take her in tow on the ninth, but the hawsers broke. The Maasdam then got her after engine working and on November 10 proceeded without assistance, but when she reached Plymouth her after engine broke down just as she got inside the breakwater. The vessel anchored and her passengers were taken off and sent to New York on another steamer.

Ice Breaking Steamer for the Arctic.

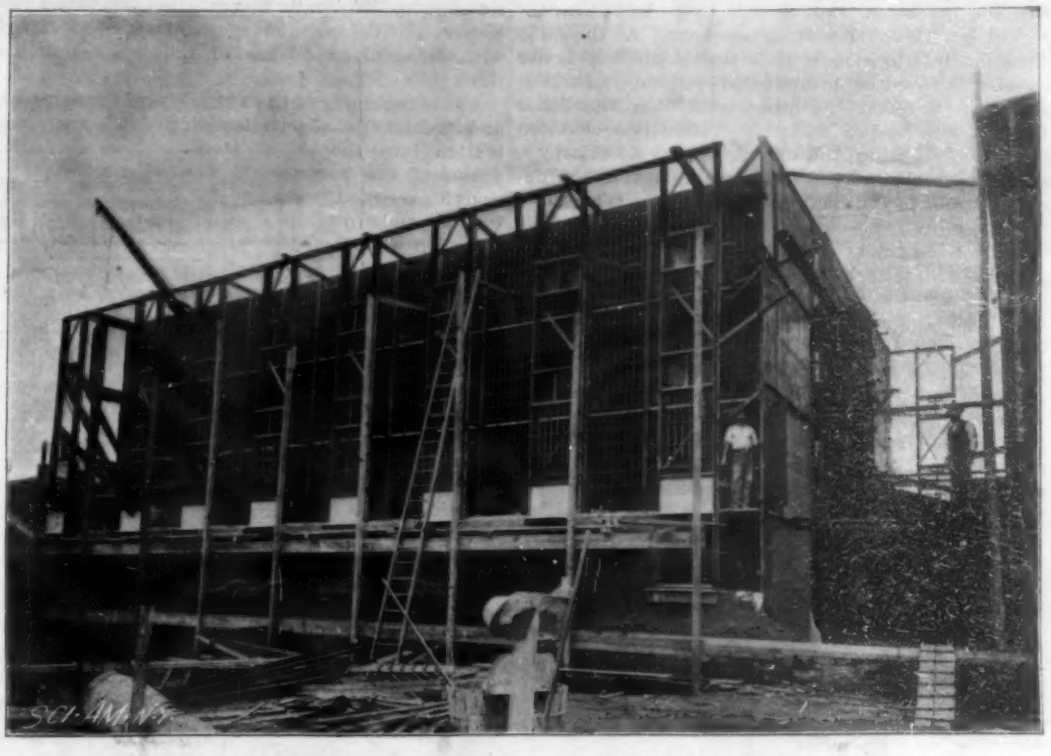
Capt. Sverdrup, of the Fram, Nansen's Arctic vessel, has arrived at St. Petersburg to take part in the proceedings of a conference which is to be held in that city for the discussion of the feasibility of constructing an ice-breaking steamer to penetrate the Arctic Sea, specially along the coast of Siberia.

THE STEEL CELL AND CENTRAL CORRIDOR SYSTEM OF PRISON CONSTRUCTION.

The new addition to the Erie County Penitentiary at Buffalo marks a departure from the commonly accepted methods of prison construction, and introduces features which not only increase the security with which the prisoner is held, but conduce to far better sanitary conditions than obtain under the common methods of construction. A prison building constructed on the ordinary lines consists of strong outer walls pierced with grated windows, inclosing a central block of cells, which have balconies provided at each story. The cells are provided with swing doors opening onto the balconies, and the balconies are provided with a railing which is usually about 3 or 4 feet high.

There are several objections to this system. In the first place, the security of the prison depends upon the outer walls and the gratings which cover the windows. Then the heating and ventilation are generally imperfect, the higher rows of cells becoming too warm and the lower too cold, as the result of the heated air rising to the top of the main building. The lighting also is usually very poor, as the cells are from 15 feet to 20 feet removed from the outer wall of the building, and the only light that the prisoner gets comes through the grated doorway of the cell. There is a further objection to this system on account of the unprotected condition of the balconies, which, with their low railings, present an easy means of violence by the prisoner throwing himself or the turnkey over, as has at times been done.

The Erie County Penitentiary has been designed with a view to obviating these defects. It will be seen by reference to Figs. 1 and 2 that many of the features just enumerated have been entirely reversed, and that instead of being from 15 to 20 feet from the outer walls, the cells are now placed only 3 feet distant from the walls, thereby providing a wide and roomy corridor down the center of the steel inclosure. This corridor, which is lighted by a skylight which extends over the entire length of it, forms a very commodious exercise corridor and a space in which the prisoners may be safely fed if so desired.



THE STEEL CELLS BEFORE OUTER WALLS WERE CARRIED UP.

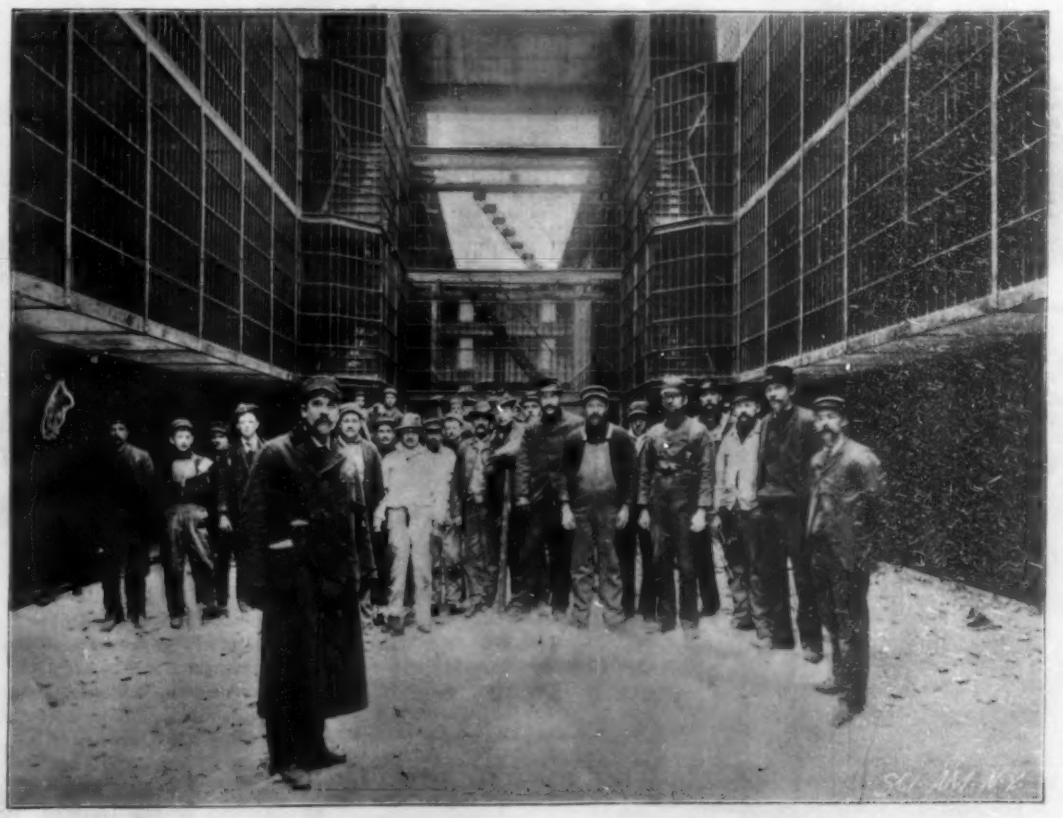
CENTRAL CORRIDOR BEFORE CONSTRUCTION OF BALCONIES.

The exterior walls of the 300 cells and the ceilings inclosing them are made of tool-proof steel grating. The vertical bars of this grating (see Figs. 3 and 4) consist of 1¼ inch hexagonal steel spaced 6 inches on centers. The cross bars measure ¾ inch by 3 inches and are placed 12 inches on centers, the whole being interlocked in the following manner: The hexagonal vertical bars are provided at every 12 inches of their height with a circular recess, as shown in Fig. 4, which gives 12 shoulders, 6 above and 6 below the cross bars. In putting the grating together, the vertical is inserted into the horizontal (the opening of the latter being hexagonal in shape) and is given one-sixth of a turn, so as to bring the projecting shoulders above and below the metal of the cross bars and securely lock them together. A counterlocking bar is then placed at the top of the joint and is riveted securely to it. It will be seen from Fig. 3 that the counterlocking bar prevents the vertical bar from being turned back, and, consequently, when the prison-grating is once set up, the whole system is firmly locked together. The bars are made of a steel which is saw, file and drill proof, and it renders unnecessary the heavy outer walls which are common in prison construction.

Ventilation and the separation of each tier of cells is secured in the following way: On the outer walls of the building in each story are located ordinary steam heating pipes, and above each set of these are the cold air registers. Each section or story is arranged so that the register and the steam can be turned on independently. The air, heated by the pipes, passes through the cells and underneath the door at the front of the cells and then rises to the skylight above the central corridor, as indicated by arrows in Fig. 2. It will thus be seen each prisoner secures the first use of the pure air from the outside. Each cell, moreover, is supplied with additional registers, which can be operated by the prisoner himself, who can regulate the heat at will.

The three feet of space between the cells and the outer wall is utilized as a jailer's corridor, through which the guard can observe the movements of the prisoners. This, it will be understood, is the only side of the cell that is provided with gratings; the floor, ceiling, side walls, and the door opening onto the prisoners' balcony being made of plate steel, and it is through this grating that the prisoners receive the abundance of light from the large windows only three feet away in the main outer wall of the building. The plate steel door of the cell is furnished with a ventilator which is so arranged that when the cell is closed observation of the opposite cell and vice versa is impossible. This, it may be remarked, is the first prison in this country that has been so arranged that a prisoner can be isolated from his fellow prisoners, and obtain an abundance of light and independent ventilation without being thrown in contact with his fellow prisoners. It will be seen, from the illustration of the central exercise corridor and balconies, that the railings around the balconies are extended the whole height of each story, so as to make it impossible for a prisoner to jump over or force his keeper or other prisoners over the balcony rail. The inclosure of each balcony separately gives the keeper an easy means of separating different classes of prisoners and of taking each class out independently for exercise in the central corridor or for work in the shops.

The locking bars governing the doors of the cells are so arranged, as

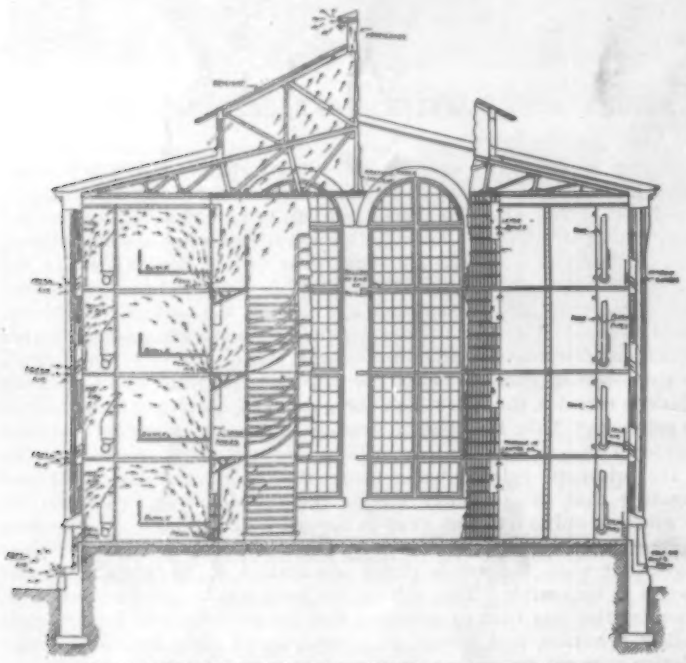


CENTRAL EXERCISE CORRIDOR AND BALCONIES, ERIE COUNTY PENITENTIARY, BUFFALO.

to allow the entire row of cells to be locked or unlocked by the movement of one lever. At the same time the interlocking is such that a single prisoner can be removed or incarcerated without disturbing the lock bars on the other cells. On the other hand, if the keeper wishes to retain one or more prisoners, releasing the others, he can do this by a simple operation of the lock bar, unlocking the desired number of cells and leaving the balance locked.

About midway of the length of the central corridor the various balconies are connected by a short cross gallery, or watch tower, as it is called, from which the guards are able to watch the door of every cell in the building. The guards' walk at the rear of the cells is built of stone, and is carried on steel angles, which are placed at the same height as the cell floors; outer angles being laid up as the masonry progresses. This walk serves, as we have already described, to form a complete floor from the corridor side of the cells to the outside door of the building, and, as it is perfectly airproof, the system of ventilation, as above described, is carried out to perfection.

This separation of the cells conduces to considerable economy in the operation of the prison, inasmuch as if only one line, or say twenty or thirty cells, are in use, it is possible to heat this particular floor, thus doing away with the necessity of heating the whole prison when only one-half or one-quarter of it is in actual use. The plans of this building were drawn up by the Van Dorn Iron Works Company, of Cleveland, O., the builders of the cellwork, to whom we are indebted for our illustrations and particulars.



2.—CROSS SECTION SHOWING METHOD OF VENTILATION.

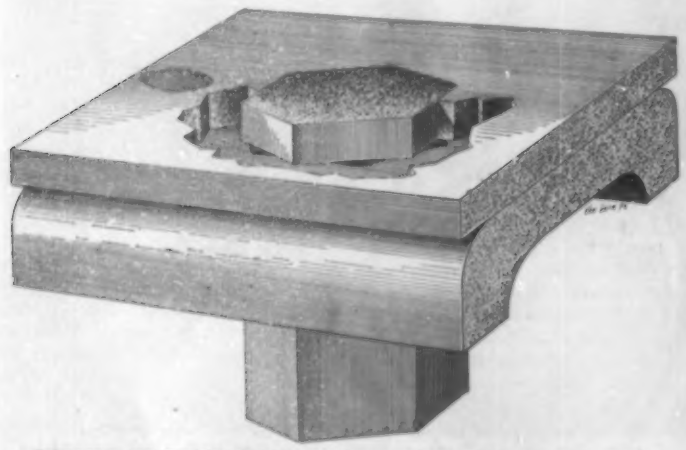
Tuberculous Disease in Fishes.

An interesting contribution to comparative pathology, by Prof. Dubard, of the Dijon school of medicine, is published in the Province Médicale, says the New York Medical Journal. M. Dubard begins his communication with the remark that chance often effects more than patient investigation, as is shown by the fact that after several years spent in bacteriological studies of cold-blooded animals he lately had the good fortune to observe a remarkable case of tuberculous disease in the carp. He then goes on to say that he has long been engaged in trout culture in an abundant spring of pure cold water, of a temperature of from 55·6° to 57·2° F., on a piece of property situated near Dijon. In a reserved portion of the stream eight carps, the remnants of experiments in pisciculture, were placed in October, 1895. For two or three years servants had habitually cast into this part of the watercourses the dejecta and sputa of a person suffering with tuberculous disease of the lungs and intestines.

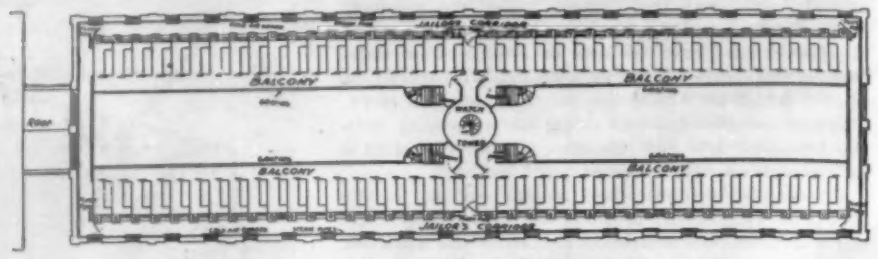
At the beginning of the winter one of the carps died, and its condition of putrefaction precluded any examination into the causes of the lesions it presented, but M. Dubard's attention was directed to the state of the remaining carps. Three of the seven were found to have tumors of the flank, and these were investigated jointly by M. Bataillon, M. Tene, and M. Dubard. It was found that the first tumor observed, on February 20, 1897, was as large as a hen's egg and had the consistence of a sarcoma. It was formed at the expense of the kidney. Although readily concealable in places, it was elsewhere continuous with the sound renal tissue. Microscopical preparations of the growth showed innumerable bacilli which stained like Koch's bacillus. Amid the lumina of the vessels and the connective tissue, both more or less inflamed and invaded by leucocytes, there were the same bacilli, some of them free, but most of them included in phagocytes. At certain points the formation of tuberculous giant cells was readily recognized.

An extensive series of cultures and inoculations was undertaken. The cultures succeeded at the ordinary temperature, about 57·2° F., but they did better at from 69·6° to 80·6°. At from 96·8° to 98·6° their growth was slow and very difficult to start. There is little difficulty, remarks M. Dubard, in choosing a suitable medium for this micro-organism, but its development requires the presence of oxygen. All the cultures produce bacillary toxines identical with the toxines of the tuberculous disease of birds. On cultures that are a little old there are found dichotomous forms, filaments more elongated and flattened and presenting points where the coloring matter accumulates to a degree suggesting the existence of chlamydospores. On solid media, the closer the temperature to 96·8° F., the more does the dry, scaly look of the cultures distinguish them from those of the tuberculous disease of birds and make their characteristics those of a culture of human bacilli. If bouillon is used, whether a pellicle forms or the growth goes on at the bottom of the vessel, the liquid never becomes cloudy. At a temperature of from 75·2° to 81·2° F., which seems to be the best for this form, the cultures begin to grow in from five to seven days. As regards inoculations of animals, M. Dubard can say little, except that in the course of from seventeen to twenty days there was obtained in the frog a "superb" pleural, pulmonary, mesenteric, hepatic, and splenic tuberculous formation. The results obtained with warm blooded animals the investigators will make the subject of subsequent communications.

The second tumor, examined on April 18, was also renal, and it showed precisely the same lesions and bacilli as the first one. The third carp, which was not very decidedly affected, was kept with a view to provide against possible failures or obstacles in the investigation. M. Dubard inclines to the belief that the microbe found in these carps is a cyprine variety of Koch's bacillus, and that the trinity of tuberculous disease — of man, of birds and of fishes — is one fundamentally.



3.—DETAILS OF INTERLOCKING JOINT—GRATING OF ERIE COUNTY PENITENTIARY CELLS.



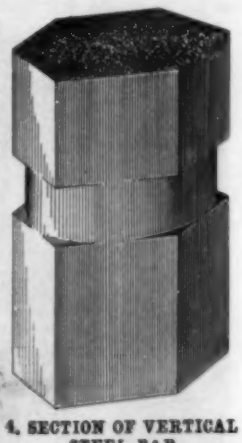
1.—PLAN OF ERIE COUNTY PENITENTIARY.

Dr. Carl Peters Punished.

A special dispatch from Berlin dated November 15 says that the court martial has confirmed the sentence of the lower court upon Dr. Carl Peters, the well known African explorer, former German high commissioner in Africa, ex-chairman of the German Colonial Society. He was charged with extreme cruelty toward the natives when he was commissioner in Africa in 1891. Dr. Peters is dismissed from the German service and has been ordered to pay the entire cost of the prosecution. The indictment charged him with arbitrarily hanging a negro boy in 1891 and the next year a negro girl, and also unjustly making war against Chief Malamia. Dr. Peters protested that he was not guilty and affirmed his belief that in his official capacity he was vested with the power of life or death. He claimed he was obliged to inflict the death penalty in the cases specified in order to save German prestige.

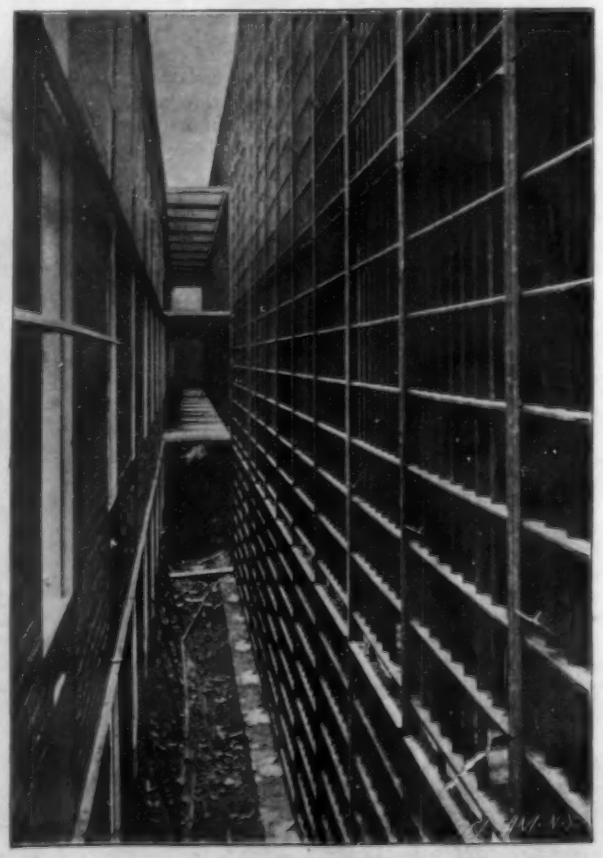
Borax.

The first issue of the Western Homes, published at Topeka, Kansas, contains many practical suggestions. The following is one of them: Borax has a great variety of uses. It is a great purifier. Wash out the sink and clean the kitchen table with it to keep them sweet. It is a good wash for many skin diseases, though it is poisonous to some persons. It should never be used too freely by any, as it combines with the oil of the skin and hair, leaving the skin dry and the hair brashy. It softens water, and if dishes must be washed in hard water, it will prove a great help. In the laundry, it makes the washing easier and helps whiten clothes, especially if soap containing borax is used. Strong borax water will aid in removing stains made by machine grease. It is good to cleanse brushes, combs, silver and glass. It is a good gargle for sore throat. It is said that a tiny pinch put in the water wherein the face is washed will remove freckles, if persisted in. The fact that it is poisonous to some must be remembered in this connection. It will destroy roaches. It whitens the teeth, and is a good wash for inflamed eyes.



4. SECTION OF VERTICAL STEEL BAR.

EGYPT'S population, according to the census just taken, is 9,700,000, an increase of 2,900,000 since 1882, or about 42 per cent in fifteen years.



GUARDS' WALK AROUND THE CELLS.

THE GIANT REDWOOD TREES OF CALIFORNIA.

An interesting story attaches to the huge slab of wood which is shown in the engraving suspended between two railroad cars ready for shipment to England. At a dinner recently given by an American millionaire to a party of English friends in London, the guests had expressed their incredulity at the account given by the host of the mammoth trees of California. To prove his assertions, he offered to wager that he could procure from one cross section of a big tree a table large enough to accommodate all of the forty guests then assembled. The wager was accepted and an order was promptly given which resulted in the shipment of a cut from a redwood log, which was two feet thick and over fifteen feet in diameter.

The engraving shows the novel method of transportation. The possibility of the slab splitting in two, or of a section of it becoming detached, was guarded against by passing two one-inch rods entirely around the circumference and drawing them tight with screw bolts. Two large chains were then slung beneath the slab and made fast to two heavy timbers, one on each side of it, the ends of the timbers resting upon two rail-

SLAB OF REDWOOD FOR A LONDON DINING TABLE DESIGNED TO SEAT FORTY GUESTS—DIAMETER 15 FEET.

road cars. The lower edge of the slab was a few inches clear of the rails, and the method of supporting it allowed the cars to swing freely in passing round the curves. Before shipping it was dressed down to the required size, and it finally left San Francisco for London by the German ship Maria Hackfield.

The slab was cut by the John Vance Mill and Lumber Company, of Eureka, California, and for the photograph we are indebted to Mr. A. W. Ericson, of Arcata, in the same State.

In felling these giant redwoods the tree is usually cut at a point a few feet above the ground, so as to avoid the great thickness which occurs at the bottom of the stump. Notches are cut in the tree just below the line at which it is to be cut through and planks are inserted in the notches, to form a platform for the two axmen. The tree is then "undercut" on the side toward which it is to be felled. The undercut is V shaped and generally reaches about half way through the tree, the lower face of the cut being horizontal and the upper face sloping to meet it at a steep angle. When the undercutting is complete, the tree is cut through from the opposite side with large crosscut saws, the fall of the tree being guided and hastened somewhat by driving wedges into the cut behind the saw. The tree gives warning of its fall by the cracking of the remaining fibers, and if proper precaution is taken, there is no danger attending the incredibly swift descent of a falling tree, though accidents do occasionally happen, due to the carelessness of the lumbermen.

Water Power and Momentous Changes.

The purposes, says a writer in The Spectator, for which water power is being utilized are exceedingly varied. It is used directly as electrical energy for lighting purposes and for chemical and metallurgical operations. Transformed again into mechanical energy by means of the electric motor, it is used for working tramway systems, for producing wood pulp for paper making, and for driving machinery of all kinds at the mines or in engineering and other workshops. The significance of this new step forward in the application of water power to industrial purposes is startling. On the one hand, it signifies that man has at last learned how to effectually master and utilize one of the mightiest natural forces of the earth.

Coal is an exhaustible possession, and the day must come when the coal fields of the earth will be worked out. Our rivers and falls offer, on the other hand, an inexhaustible supply of energy; for so long as the heat of the sun evaporates the water of the sea, and causes it to fall again as rain upon the hills or as snow upon the mountains, this source will be available for the supply of man's wants, and the arrival of the time when the earth's coal fields will be exhausted need no longer be awaited with misgivings. But there is another aspect of this development which is less cheerful for contemplation by three of the nations of Europe. The position which England, Germany and Belgium occupy to-day as the leading manufacturing countries of Europe has resulted chiefly from their possession of extensive coal fields capable of cheap development, coal having been in the past the chief factor in determining the industrial progress of any country. The progress of electrical science has, however, apparently changed the conditions of industrial supremacy, and it appears as though the possession, not of coal fields, but of water power, will be the determining factor in the future.

Whether the check to the natural growth and expansion of industry in the older manufacturing countries of Europe, that may already be observed as one result of the increased use of water power in countries hitherto of little or no account in the industrial struggle, will be followed by the gradual migration of the staple industries to the cheaper centers of power remains for the future to disclose, but it is a question of tremendous significance for the prosperity of the countries concerned.

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RECENTLY PATENTED INVENTIONS.

Engineering.

MOTOR VEHICLE.—Henry W. Heaton, Oneyville, R. I. This is a four-wheeled vehicle, in which oil or gas may be used to actuate the motor, the vehicle being easily started, stopped and steered. The motor comprises a revoluble combustion chamber fastened on a main driving shaft, between which and the rear axle is a transmitting device, cylinders opening into the combustion chamber, and there being an intermediate mechanism between the pistons of the cylinders and a series of gear wheels rolling off on a fixed gear wheel. In the combustion chamber is an electric igniting device, which is actuated by the rotation of the chamber.

DESULPHURIZING MATTE OR OTHER FURNACE PRODUCTS.—James L. Wells, El Paso, Texas. An apparatus for reducing low grade matte and other furnace products, producing high grade matte or metal in a very simple and economical manner, has been devised by this inventor. The furnace is provided with the usual stack, having a water jacket, and tuyeres are arranged on opposite sides to open into the molten metal, the tuyeres being connected with an air blast with a high pressure air supply. The tuyere consists of a tubular shell, in which a longitudinally divided plug having recesses in its sections forms a longitudinal bore, the sections also having abutting projections engaging a corresponding recess of the shell to prevent the plug from turning.

Electrical.

LOCK CIRCUIT CLOSER.—Charles E. Pierce, New York City. In an electric alarm to be operated when an attempt is made to force the lock of a door, according to this invention, a frame piece is employed carrying two normally disconnected contact points and a lever movable to engage them and thus close the circuit, the device being placed in such position that the lever will be rocked by the bolt of the lock when excessive pressure is applied to the lock, as when the door is sprung by a jimmy or otherwise. Several forms of the device are shown in the patent.

Bicycles, Etc.

HANDLE BAR.—Henry W. Heaton, Oneyville, R. I. To reduce to a minimum the transmission of vibration through the handle bar from the frame of the bicycle, in riding over rough places, is the object of this invention, according to which a clamp engages the handle bar and the handle bar stem has a head made in sections inclosing the clamp, there being an elastic material between the clamp and the head and means for drawing the head sections together and clamping the several parts firmly in place, the elastic material taking up the vibrations of the stem. By having the surface of the handle bar roughened, a very firm contact is obtained between the elastic material and the handle bar, preventing possible turning of the latter in the head.

DIFFERENTIAL BICYCLE GEAR.—Guy R. Bullock, Centerville, Canada. To allow a rider to readily and conveniently change from a high gear to a low gear, and vice versa, this invention comprises principally a hollow drive wheel hub provided with differential gear wheels, a double gear wheel being laterally slidable to mesh with either of the hub gear wheels, while a driven sprocket wheel is in gear with the double gear wheel to rotate the latter within the hub and permit its lateral movement. The entire device for transmitting motion to the drive wheel is completely inclosed within the hollow hub, and is thus thoroughly protected from dust and other impurities, and is not liable to get out of order.

DETACHABLE CARRIER FOR BICYCLES.—William M. Tegart, Mocsomin, Canada. To facilitate carrying a camera, baggage, etc., on a bicycle, this inventor has devised a carrier which may be conveniently attached to or removed from a bicycle. It comprises a back frame adapted to be clamped to the steering head, and a supporting bracket or bottom frame formed of two sections having a hinged and sliding connection with each other, the inner section being hinged to the back frame. The device is not in the way of the handle bar or the fork for the front wheel, directly above which the load is supported.

Agricultural.

REAPING MACHINE.—Mihail Alexandrescu, Bucharest, Roumania. This is a machine adapted to be pushed along by a draught animal, when it grasps the corn to be cut, bends it down and conveys it to the knives, the cutter bar having motion imparted thereto from the axle. The corn falls upon an endless apron passing over rollers rotated from the axle and is conveyed onto a rack where it collects until it falls to the ground, when the rack is moved inward.

Miscellaneous.

RACE STARTING MACHINE.—Victor Carandini, Calcutta, India. According to this invention a fence or barrier is mounted transversely to the track, in connection with means for raising and lowering it quickly, so that upon raising the barrier the horses may pass. The barrier is formed of two bars with flexible connections and slight independent movement, there being a restraining device for each bar and means tending to lift the bars, while a flexible connection is capable of tripping the restraining device for the second bar when the first bars moves upon being released. The barrier moves upward on the drawing of a cord by the starter.

NECKTIE FASTENER.—Gustave Selensky, New York City. This is a simple and inexpensive device to be applied to any neckstrap necktie, and which can be quickly and accurately adjusted to fit the tie to any size of neck. It comprises hook and eye straps and a connecting device having at one end a loop embracing the hook strap and at the other end a hook to engage the eye of the eye strap.

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Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(7242) E. E. S. asks: Will the galvanometer, described in "Experimental Science," show how many volts and amperes of a current, with proper scales? If it will, will you give me proper instructions how to make proper scales? A. The tangent galvanometer of "Experimental Science" will measure amperes; but no permanent scale reaching amperes could be attached to it. Any change in the strength of the needle would change the value of one ampere on the scale. Any good text book of electricity or of physics will explain the tangent galvanometer, but you will not understand it easily unless you have a knowledge of trigonometry. To measure volts with a galvanometer, you require a coil with a large number of ohms resistance. The Depres-D'Arsonval galvanometer, of "Experimental Science," has hardly resistance enough—150 ohms. Here the scale is an ordinary scale. If you have one volt and can find how far the spot of light moves for it, you can then measure volts. The Daniell's cell gives nearly 1·1 volts. All voltmeters and ammeters are graduated where volts and amperes are at hand with which to make the graduation. You may be unable to do it. All voltmeters and ammeters with scales reading volts and amperes directly are made without magnetic needles, since these easily change their magnetic strength, which would change the value of a given deflection on a scale.

(7243) W. F. R. ask: Is there any direct way, that is, by means of converters and the like, of changing an alternating current into a continuous one? A. The only way to transform an alternating current into a direct current is to run a motor with the alternating current, and with this motor drive a direct current dynamo, which will give the voltage and amperes required. These two machines are sometimes wound on same shaft and called a motor dynamo.

(7244) H. C. C. writes: Please explain how nitrate of gold may be separated? A. It is very doubtful if there be a nitrate of gold. If there be, it is an unstable compound which is reduced at once to oxide of gold or to metallic gold. Fuming nitric acid will dissolve fine gold leaf, but even by shaking the solution with water, the precipitation of gold oxide takes place.

(7245) E. Y. M. writes: I am making the tangent galvanometer described in "Experimental Science." Please inform me what size and kind of wire, also length, to use for the different coils of same? A. For the coils of the tangent galvanometer, as described in "Experimental Science," use No. 27 Am. wire gage copper wire (cotton-covered magnet wire will answer).

	Ohms.	Ft.	In.
For coil b	1	19	5
For coil c	9	174	7
For coil d	40	770	0
For coil e	100	1940	0
Total		2900	0

The weight required is a little more than 1¾ lb.

(7246) J. G. B. asks: What is the difference between an incandescent light of 100 volts, 16 candle power, at 3½ watts per candle power, and one of the same voltage and candle power but of 2½ watts per candle power? I understand the difference in horse power, but not in the lamp or light. Why not use 2½ watt lights in the place of 3½ watt, because there could be more lights used per horse power? A. You can light more lamps per horse power at 2½ watts per candle than at any higher rate of power, but you will burn your lamps out a great deal faster than the decrease of power at 2½ watts will balance. It is more economical to consume three or more watts per candle than to consume the carbon filament so fast and thus shorten the life of the lamp. It is the interest of the lighting company to prolong the life of the lamp, but it is the interest of the user to obtain a large amount of light. There must be a compromise somewhere, and it is made at about 3½ watts per candle.

(7247) W. H. F. writes: I have come across a substance that I think is a compound of acids. If you put a drop of water on this substance, it ignites immediately. Will you please tell me the name of this substance and how it is made? A. We cannot tell the name of a substance we have never seen simply by knowing one property of it. If a drop of water be put on potassium, it will be decomposed and the gas which results will be set on fire. So also sodium will set fire to a drop of hot water. Both these metals are soft, silvery in color when freshly cut, and are kept under kerosene oil for safety. It may be one of these which you have.

(7248) W. M. M. asks: Is there any chemical that will cause the silver on an electric print to disappear? We know that the chloride of lime will do it, but it will not remain away. I want something that will be permanent. These prints are those which are used for crayon work. A. The disappearance of the print when treated with solution of chloride of lime is due to the fact that the chloride of lime changes the silver of the print into chloride of silver, which is white and does not show. To prevent this from turning black again by the light, it must be dissolved and washed out. Prepare the following bath:

Water, distilled	50 parts.
Cyanide of potash	1 "

Soak the print in this for 15 minutes. Wash for one hour in running water and dry. In other words, treat the print as you would any photographic print in fixing, washing and drying. Hyposulphite of soda, 1 in 8 of water, will dissolve the chloride of silver, but is not so powerful as the cyanide. It must never be forgotten that cyanides are most violent poisons, and great care must be exercised in their use, lest they get into the system by the mouth or through a cut in the skin.

(7249) V. W. writes: In your SUPPLEMENT there is a description of a Wimshurst electrical machine, with directions to make it, and in the directions it says to use for the accumulating Leyden jars the hock bottle, and I do not know where to procure these, cannot get them here and do not know to whom to send for them. Will you please inform me as to the closest point here that I can get them; also give name of dealer? I am making one of these machines and would like to have the bottle at once. A. All the glass parts of a Wimshurst or similar electric machine, and all glass apparatus to be charged with electricity, should be free from lead. Glass which contains no lead is called "crown" glass. It is impossible to recognize this glass by its appearance. The best you can do is to get a good window glass for the plates. To test the bottles for the Leyden jars, wash them and dry them thoroughly. When cold, rub them with a dry and warm silk handkerchief or other piece of silk. A suitable bottle will show strong signs of electricity, crackling or even yielding a spark when the finger is presented to it. It is more convenient if these bottles have a wide mouth. You need not be particular to get "hock" bottle; any bottle which will stand test as above is good. A greenish bottle is likely to prove to be of good glass for electrical uses.

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For which Letters Patent of the United States were Granted

NOVEMBER 16, 1897,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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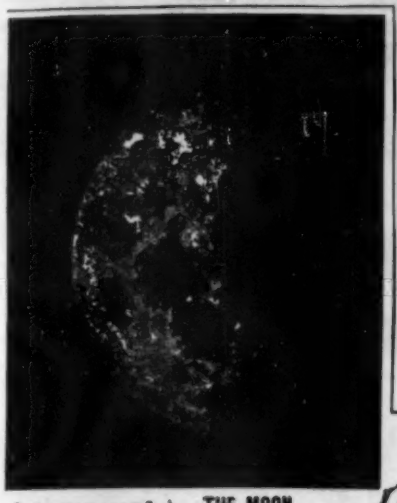

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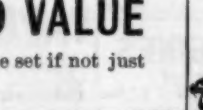

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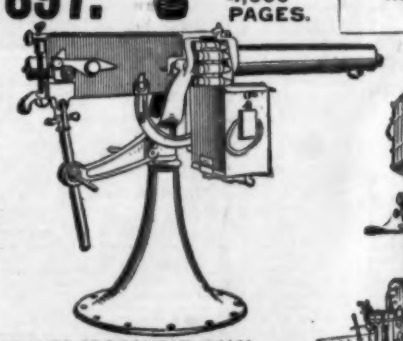

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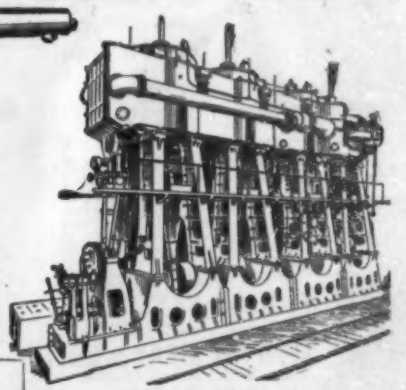

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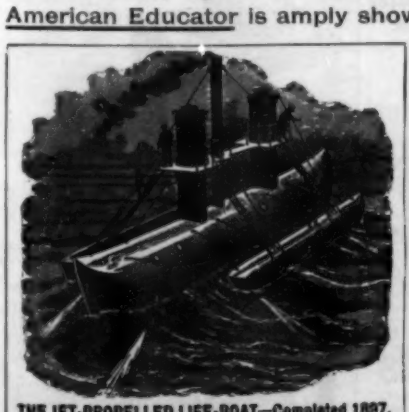

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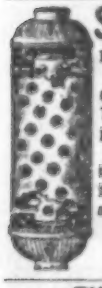

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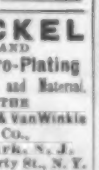

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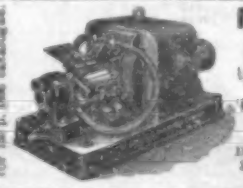

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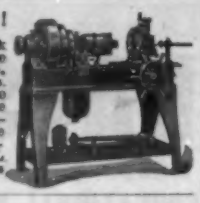

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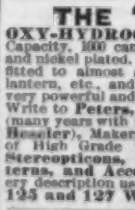

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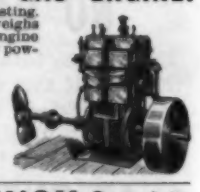

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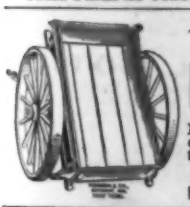

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Tires, hose, belting and horseshoes, articles composed in whole or in part of rubber, including, Whitman & Barnes Manufacturing Company	30,838
Tobacco and cigarettes, chewing and smoking, Liggett & Myers Tobacco Company	30,841 to 30,843
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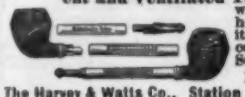

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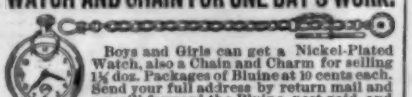

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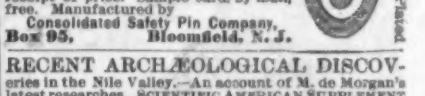

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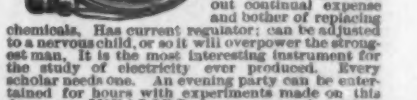

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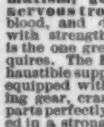

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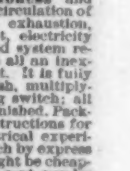

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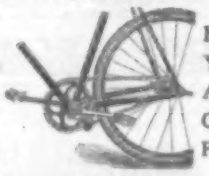

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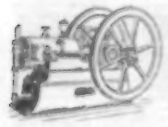

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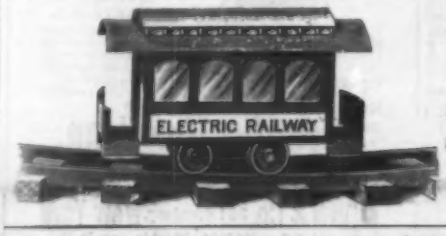

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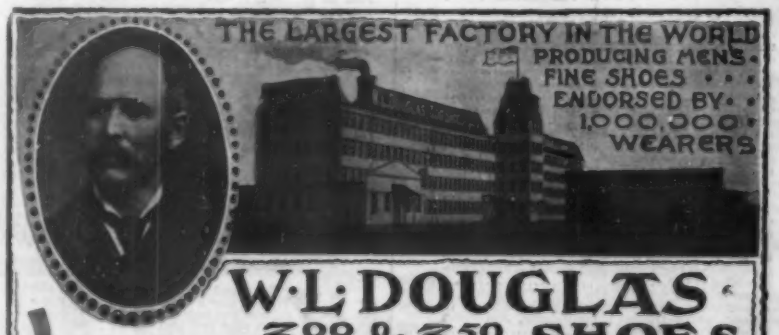

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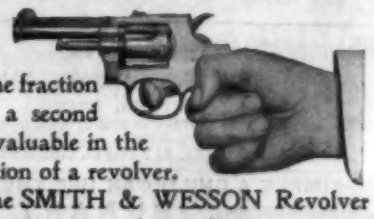

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